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AUTHOR	Zupfer, John; And Others
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ABSTRACT

The document is comprised of 91 career-related science modules for junior high school students, indexed by the learning activity's title and cross-referenced by occupation. The modules are intended for use in an individualized science program, either as an ongoing curriculum supplement or as a discrete unit. Integrated with the presentation of scientific theory, knowledge, and skills are information on applications in work settings and on employment opportunities in science and other fields. Problem-solving and science learnings relevant to students' practical, daily needs are emphasized. The module format, an illustrated worksheet, includes: title, cluster, occupation, prerequisites, objectives, equipment, procedure, data and results, evaluation, and teacher supplement. Most of the modules were designed to be completed during a 50-minute period, with equipment which can be stored in a small container. An introduction orieints the science teacher to career education concepts and objectives, relates the goals and objectives of the career-science program, and specifies the science processes and skills which are developed in the modules. Alternative methods for using the modules are suggested, and a student introduction is provided. The modules are heavily biased toward traditional sex roles; no racial minorities are pictured in the illustrations. (Author/AJ)

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SCIENCE UNIT
(CAREER RELATED)

U.S. DEPARTMENT OF HEALTH,
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OF EDUCATION

VOCATIONAL TECHNICAL DIVISION

CAPITOL SQUARE BLDG.
ST. PAUL, MINNESOTA

State of Minnesota

Department of Education
Capitol Square, 550 Cedar Street
St. Paul, Minnesota 55101

DEAR EDUCATOR:

THIS DOCUMENT IS PART OF A PROJECT FUNDED BY THE MINNESOTA DEPARTMENT OF EDUCATION, DIVISION OF VOCATIONAL-TECHNICAL EDUCATION. IT WAS DEVELOPED TO SHOW HOW SCIENCE CURRICULUM CAN BE ENHANCED BY ADDING REAL-LIFE CAREER ORIENTED AREAS REQUIRING SCIENCE SKILLS.

IT SHOULD PROVIDE STUDENTS WITH CAREER ORIENTATION AND EXPLORATION EXPERIENCES AS WELL AS BEING AN EFFICIENT, RELEVANT TEACHING VEHICLE FOR HELPING STUDENTS ENJOY LEARNING SCIENCE SKILLS.

RMMad

Robert M. Madson, Director
Program Operations
DIVISION OF VOATIONAL-TECHNICAL EDUCATION

RMM/LBK/dlr

ROSEVILLE AREA SCHOOLS

Independent School District #623
1251 West County Road B-2
St. Paul, Minnesota 55113

CAREER RELATED SCIENCE UNITS

Teacher Edition

An exemplary project funded in part by the Minnesota State Division of Vocational Education.

Robert Van Tries
Associate Commissioner of Education
State of Minnesota

Vernon M. Vick
Adm. Ass't. for Occ. Ed., L.P.D.
Roseville Area Schools

July, 1973

ROSEVILLE AREA SCHOOLS
Independent School District No. 623
1251 West County Road B-2
St. Paul, Minnesota 55113

The materials in this project have been prepared by:

John Zupfer	Capitol View Junior High School Science Teacher
Gary Engstrom	Bryant Junior High School Science Teacher
Dan Morton	Capitol View Junior High School Science Teacher
Ted Molitor	Science Consultant

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CAREER RELATED SCIENCE EVALUATORS

Dan Morton	Capitol View Junior High School Roseville, Minnesota
John Zupfer	Capitol View Junior High School Roseville, Minnesota
Marcia Keyes	Capitol View Junior High School Roseville, Minnesota
Elsie Rivard	Capitol View Junior High School Roseville, Minnesota
Darlene Holt	Capitol View Junior High School Roseville, Minnesota
Chris Houle	Fairview Junior High School Roseville, Minnesota
Art Beisang	Fairview Junior High School Roseville, Minnesota
John Olson	Fairview Junior High School Roseville, Minnesota
Cathy McIntosh	Parkview Junior High School Roseville, Minnesota
Gary Engstrom	Bryant Junior High School Minneapolis, Minnesota

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ST. PAUL, MINNESOTA 55165
TELEPHONE (612) 645-8511

FOREWORD

Perhaps the most heralded new focus of education in the 70's is "career education." In Washington, in Minnesota, in cities around our state, educational leaders, legislators, and citizens alike have accepted the term career education as synonomous with a challenge to making our current educational experiences more relevant to the adult workaday world. It is a term recognized to mean giving our boys and girls during their compulsory school years an opportunity to survey the opportunities for adult employment in a modern and ever changing American economy.

Sperry-Univac is proud to contribute to this overall effort by publishing this edition of applied career education materials. Interwoven into the presentations of scientific theory are indications of application and opportunities for scientific employment. The presentation of such basic curriculum material truly does provide an orientation and exploration of the world of work.

More importantly, this volume gives evidence to an even more foundational justification for an emphasis on career education. The use of examples of the everyday application of the principles of sciences help teachers and their students better appreciate the practical value of all education. Such an approach should end forever the traditional lament of the young person, "What good is it?"

SPERRY UNIVAC IS A DIVISION OF SPERRY RAND CORPORATION

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THE ROAD NOT TAKEN

Two roads diverged in a yellow wood,
And sorry I could not travel both
And be one traveler, long I stood
And looked down one as far as I could
To where it bent in the undergrowth;

Then took the other, as just as fair,
And having perhaps the better claim,
Because it was grassy and wanted wear;
Though as for that the passing there
Had worn them really about the same,

And both that morning equally lay
In leaves no step had trodden black.
Oh, I kept the first for another day!
Yet knowing how way leads on to way,
I doubted if I should ever come back.

I shall be telling this with a sigh
Somewhere ages and ages hence:
Two roads diverged in a wood, and I--
I took the one less traveled by,
And that has made all the difference.

Robert Frost

INTRODUCTION

Career development is an area of education that is receiving much attention today, and there is good reason for this emphasis. Teachers have long been concerned with the apparent dichotomy of teaching college oriented science courses to groups of students, a majority of whom are not college bound. We in education have talked about comprehensive education while practicing college preparatory methodology. Teachers have also been concerned with classroom subject matter relating to "real" life situations. This problem arose from the inabilities of teachers, schools and curriculums to show the applications and uses of learnings to real life and the world of work. Many educators feel today that there has been a definite failure to relate school subjects to real life situations, and when this occurs student motivation and interest lag. Career education can provide a broad base for comprehensive offerings in the schools, while helping the subject matter areas to relate content to living. The relationship of all school subjects to potential careers provides an unbiased vehicle for learning science - and all other subject matter areas.

The main problem in career education is informing and making students aware of the varied careers available to them that are commensurate with their talents and potentials. It is true that students must first discover their talents and weaknesses before they can choose a satisfying and fulfilling career. It has been the goal of education to give to students this self-awareness. However, little has been done to enable students to match their likes, talents and personal qualities to a specific career.

This project represents an attempt to produce alternative materials relating the subject matter of science to all levels of the world of work.

At the present time the strong involvement of the U.S. Office of Education in career education is prompting materials and curriculums to be developed at all levels of education.

WHAT IS CAREER EDUCATION:

There are many different ways of defining career education. Hoyt calls it the total effort of public education and the community aimed at helping all individuals to become familiar with the values of a work oriented society, to integrate these values into their personal value systems, and to implement these values into their lives in such a way that work becomes possible, meaningful and satisfying to each individual.

On the other hand Evans refers to career education as "the total effort of the community to develop a personally satisfying succession of opportunities for service through work, paid or unpaid, extending throughout life."

Such definitions and others similar to them can only be meaningful if one considers the student needs which can be met by career education, the concepts and philosophy on which such education is based, the objectives based on these needs, and the possible methods which may be used to fulfill these objectives. However, authorities in career education seem to be in agreement on the general objectives of career education. So much so that the following objectives need not be attributed to any one authority since they have been studied in common by so many.

OBJECTIVES OF CAREER EDUCATION IN GENERAL

To provide experiences, which allow students to evaluate their interests, abilities, and needs related to occupational roles.

To give students opportunities for more exploration of selected job clusters.

To improve performance of students in basic areas by making subject matter more meaningful and relevant through unifying and focusing it around a career development theme.

To provide in-depth exploration and training in one job cluster leading to entry level skill leaving option to change cluster choices.

To allow students to experience and explore the processes and skills typical of a given occupation or cluster, yet fall under the objectives, methods and processes of science.

Several of these goals can be attained through good career education programs:

1. It is a viable approach to produce relevancy in the schools.
2. It provides teachers with a vehicle for exercising their responsibility to relate their subject matter to life and the real world their students now face and will encounter later.
3. While providing a base for a comprehensive approach to total education of children, and helping subject matter areas to relate their content to living, career education also provides for career awareness through career exploration.

GENERAL GOALS OF A CAREER-SCIENCE CURRICULUM

A. To instill in students an awareness of the broad range of careers available to them.

B. To integrate career information, and broaden the horizon of students as they learn to undestand and use scientific processes in problem solving, and decision making.

C. To make obvious the value of science in student's career and educational planning.

D. To show students that there are respected vocations available for all ranges of intellectual and manual talent.

E. To provide students with better techniques to understand himself, his interests, talents and abilities, and how they fit his career potential.

F. To help develop an intrinsic motivation within the students for understanding science and perceiving the value of the science curriculum.

OBJECTIVES OF CAREER RELATED SCIENCE MODULES

Students will:

1. Relate science skills, processes, and knowledge to the real world of work.
2. Learn the processes of science and apply them to potential career choices.
3. Improve their social skills and formulate good attitudes toward other humans.
4. Learn and use decision-making processes based on valid information and viable techniques.
5. Learn that planned career choices are better than chance. The sequential nature of planning choice is significant.
6. Learn that science literacy is directly related to total literacy.
7. Understand the value and place of many careers in our society, and more fully appreciate the efforts involved in becoming proficient in specific occupational persuits.
8. Learn that science is directly related to every career.

4

SCIENCE PROCESSES AND SKILLS WHICH ARE INCLUDED IN THESE MODULES

All science begins with the process of observing. Two principal processes follow:

Inferring concepts and models from the observations, and

Predicting future events.

Other processes of science related to inferring and predicting are:

- Observing
- Classifying
- Measuring
- Interpreting data
- Making operational definitions
- Communicating
- Formulating questions and hypothesis
- Testing hypothesis
- Experimenting
- Analysis
- Synthesis
- Formulaing models
- Estimating
- Evaluating

All of the processes of science have degrees of refinement. All of the processes can be learned and perfected. Decision making skills involve the processes of science. The more the processes of science are perfected by individuals and used in making decisions, the more valid is that decision.

CONCEPTS OF CAREER RELATED SCIENCE UNITS

I. Generally accepted career concepts -

1. The choice of careers may be limited because of lack of interest or or unknown talent abilities on the part of students.

2. Vocational education is a part of career education. The converse may not be true. Careers include vocations and avocations.

3. All careers generally involve science and in particular some or all of the processes of science.

4. A key objective of all education is preparation for successful careers.

5. Every teacher in every subject can emphasize the contribution that the subject can make to successful careers.

6. Learning is not confined to the classroom, but also takes place in the home, community and place of employment.

7, Choice of careers differ in form and firmness.

8. Choices of **careers** are made on the basis of what the individual enjoys, what appears possible, and what seems important.

9. The prime goal in making career choices is the process, not the end result; not what is chosen, but that it is chosen. The right to change is as sacred as the right to choose.

10. Individuals can learn to perform adequately in a variety of occupations.

11. Careers and life styles are inter-related.

12. Environment and individual potential interact to influence career development.

13. Individuals differ in their interests, abilities, attitudes and values.

14. There is a wide variety of careers which may be classified in several ways.

15. An understanding and acceptance of self is important throughout life.

16. Individuals are responsible for their career planning.

17. Career education and vocational education are not the same. Vocational education is only a part of career education.

II. Career concepts concerned specifically with "Career Related Science Units" -

1. Career awareness and exploration is the focus of junior high school career related science units. Final decision making and locking one's self into a particular career goal to the exclusion of all others is strongly discouraged at the junior high level.

2. Junior high school science activities should be obviously relevant to their present and future life styles.

3. Career related science units should be self motivating.

4. Students, while developing an awareness of the processes of science that are used extensively in specific careers, may exclude certain career choices.

5. All career clusters involve science activities; however, some clusters involve more science activities than others. The choice of career clusters and occupations was made on the basis of a survey of student interest in Roseville Area Schools (1972). Occupations that were frequently selected as students first choice were included as activity modules.

6. Significance of importance in career related science units:

    a. processes of science
    b. skills of science
    c. knowledge of science
    d. science activities related to a specific occupation
    e. career counseling

7. Detailed information on specific occupations will not be treated and included in the career related science units. This information is readily available to students in The Occupation Outlook Handbook, The Encyclopedia of Careers, and other career resource books found in most school guidance departments and libraries.

8. "Hands on" experiences will be used to teach and to motivate the learning of abstract academic content and process.

9. Career related science modules must be pertinent to specific careers, and must involve the processes of science.

ARRANGEMENT BY CLUSTER

The materials that have been produced as part of this project are organized under the career cluster concept, in order to keep from overwhelming the student and teacher. When approaching the vast number and variety of occupations there seems to be common agreement amongst career development authorities to classify a given occupation into one of the several career "clusters" suggested by the U.S. Office of Education. The cluster taxonomy chosen for this project is as follows:

1. Agri-Business and Natural Resources
2. Fine Arts and Humanities
3. Communications and Media
4. Construction and Repair
5. Consumer, Foods and Homemaking
6. Environmental Control
7. Hospitality and Recreation
8. Manufacturing
9. Marine Science
10. Marketing & Distribution
11. Personal Services
12. Public Services
13. Transportation
14. Medicine & Health
15. Business & Office

It has been proposed that the cluster approach implies:

1. Each cluster is not equal in numbers of employed workers.
2. The above cluster divisions are more inclusive than most traditional vocational education and include some areas completely foreign to previous taxonomies.
3. Occupations within clusters have more in common for working conditions than job skills or geographic location.
4. Each cluster contains the unskilled through the college trained.

Within the Agri-Business and Natural Resources cluster, for example, would fall cattlemen, county agricultural agents, vegetable farmers, fishermen, florists, wildlife managers, and many more. The occupations within a cluster have related or similar teachable skills and knowledge requirements. With the cluster approach, a student can prepare for a family of occupations rather than a specific one. He can be equipped for a number of possibilities with flexibility. Students are more likely to succeed in job entry with broad-based preparation and yet change is allowed for in-career requirements and personal aspirations.

USING CAREER RELATED SCIENCE ACTIVITIES

These activities and related exercises are termed "MODULES" and are meant to be used under an individualized approach to instruction.

FORMAT

The module format includes: Title, Cluster, Occupation, Prerequisites, Objectives, Equipment, Procedure, Data and Results, and Evaluation. Most modules were designed to be completed during a 50 minute perios. There are exceptions. A teacher supplement to many modules is included after the module where appropriate.

GETTING STARTED

The Career Related Science Modules Program may be initiated in several different ways:

1. Each student may begin by reading the Career Cluster Table of Contents to find a cluster that may interest him. After he has read the cluster information he may choose an occupation within that cluster that he would like to investigate. There are several modules for each cluster and he may choose a module he would like to pursue. It is recommended that at least two modules be completed for the same career by any given student.
2. A student may be asked to choose any occupation from the list of occupations that seem to interest him. He may then pursue a module from the several available for that occupation.
3. Another possibility for approaching Career Related Science Modules is to choose a science activity that the student would like to do from the List of Modules. After completing the modules he may investigate the careers and occupations relating to that module.

METHODS OF USE

The Career Related Science Modules are designed to be used by the science teacher in a variety of ways. They can be utilized:

1. As a class activity for the entire class, but on an individual basis. This may be done between conventional units of study.
    a. For a short period of time - one or two days
    b. For a longer duration - a week or more involving several modules or several occupations.
2. As supplementary exercises in science for -
    a. High interest of high ability students.
    b. A program involving individual learning in science.
3. As an activity relating to a chosen career cluster where all students in class use the same modules for the same period of time.

4. After completing the activity module, including the evaluation, students are asked to gather information relating to the specific career they have chosen to investigate. Information should be obtained from two principal sources:

   a. An interview with an expert in that career (see student sheet "Introduction to the Career Explorer".)

   b. Career and occupational references found in most schools including -

      Occupational Outlook Handbook

      Dictionary of Occupational Titles

      Handbook of Job Facts

      Encyclopedia of Careers and Vocational Guidance

      Career Interest Guide, Northern States Power Company

Students are encouraged to answer specific questions relating to the career they have investigated and themselves. This may be done in writing or in group discussion.

EQUIPMENT

Equipment and materials will be the most specific limitation factor in utilizing Career Related Science Units with junior high school students.

A list of material and equipment is included in each module, and suggestions are included in the Teacher's Supplements.

Suggestions

1. Store module equipment separately in small boxes or plastic dish pans. Store in numerical order according to the first page number of the module. Plastic dishpans are rather inexpensive, durable and easy to store on the shelves. Almost all materials for modules can be contained in a 12" x 12" dishpan. Small boxes may provide sufficient space for some modules. File folders will even suffice for some dry-lab activities.

2. A felt pen can be used to label the containers with the module title and page number on which the module begins.

3. Once the teacher accepts the fact that he will spend several hours shopping for supplies at grocery, drug, hardware and variety stores and actually makes the purchases necessary, the most difficult part of using "Career Related Science Activities" is over.

INTRODUCTION FOR THE CAREER EXPLORER - JUNIOR HIGH SCIENCE STUDENTS

I. Why Explore Careers in a Science Class?

Everyone uses science. Some use it better than others. Those people who make the best use of science are the most successful in doing what they plan to do. It's true! Here's why.

Science is an area of endeavor which helps us find out things we want to know in the most efficient way by teaching us the skills of using our senses to observe things carefully. Then by taking an educated guess at how these things affect us or our problem we try to solve our problem. This problem doesn't have to involve test tubes, bacteria, forces, or chemicals. Anything that we need to know or have answered or fixed is fine. Now, if that solution solved your problem you feel great. Your good observing and good guessing made your life a little easier and happier. You should try to remember how you solved that problem though because one like it may come up again and maybe you can fix it the same way. If you find that similar problems you have can all be taken care of by the same kind of action you have found a valuable law for yourself. Now maybe that same law would work for other people. You should communicate this to your friends, telling them that since this works for you you predict it would work for them. They will experiment with your problem solving method and find out if they have to make any changes for it to work for them.

Let's try this science out on a "non-science" situation.

Situation: You want to get a summer job.

First you want to find out what employers will be hiring people this summer. You will read help-wanted ads in the paper, check community bulletin boards, ask as many working people as you know, and maybe even place an ad in the paper for yourself. The more ways you can find to learn about (observe) possible jobs the better your chance of being hired.

You had better have a good idea of the kinds of jobs you would be qualified for and be able to do 40 hours a week without going nuts. This might require some talking with a counselor and your folks.

Now you have a good idea which employers to call for an interview. Before you take that interview you need to do some observing and guessing again. Decide on what appearance that specific employer will want in his workers. This may vary widely from no specific rules for construction laborers to a very neat, clean, short hair look for food preparers and handlers. You must decide if you are willing to change your standards for the job. Don't expect the employer to change his for you.

I'm sure that you can see that all through your preparation for getting a summer job you have been using science. You've been observing carefully, making educated guesses at what to do, planning and organizing your actions, making decisions from information you've found, and probably done some experimenting as to what works best in each situation. If, with your help, your teacher's, and life in general you have learned these science processes and skills well you are way ahead of someone who hasn't, and - you'll probably land a good summer job.

II. WHY DO THESE ACTIVITIES?

They are designed to -

- give information about activities involved with specific vocations to let you see what appeals to you.
- teach skills useful in all vocations and life situations.
- teach processes, which helps everyone live better.
- be practical - something which has obvious application to your future.

III. SO WHAT ELSE IS IN IT FOR ME?

You can find out through sample activities some typical actions and thought processes used in specific vocations.

You can realize that by saying I don't like and won't do a specific action or activity you eliminate some of your vocational possibilities.

Activities which you enjoy doing should be pursued by finding the occupational cluster they are in and trying other activities in the same cluster.

IV. HOW TO USE THESE ACTIVITIES FOR FUN AND PROFIT

A. Look through the index of vocations to find one or several you would consider as your life work.

B. Get the activity you wish to do from your teacher. Read through it to see if it sounds interesting. If there is more than one in a series, be sure you start with I.

Note: If you decide that you don't want to do the kinds of things listed in an activity you must be aware that you are probably removing some possible vocations from your future vocational choice. This is good to know because you don't want to hate to go to work each day. But also remember that if you say, for example, "I don't want to do math!" you have eliminated yourself from a large amount of vocations which depend on numbers such as salesman, store owner-manager, banker, carpenter, architect, detective, engineer, farmer, doctor, ranger, etc.

C. Tell your teacher which module you are doing and he will provide you with the equipment and supplies. You may have to supply a few yourself. When you get all the needed supplies together you're ready to start.

D. Carefully read the prerequisites and pretest if there is one. Complete this and check it with your teacher before you go any further.

E. Read the procedure and do the activity. There may be other students in class doing the same or similar things. Checking with them or working together may be interesting. People often work together on jobs.

F. Complete the data table and show the results to your teacher before going on to do the evaluation section if it is included in your activity. Turn in your completed module to your teacher.

G. When you are completely done clean up the equipment and work area well and return your supplies to your teacher.

H. If you enjoyed doing the activity, and felt you did it quite well, you may wish to do other activities prepared for the same. You will also note that similar vocations are arranged in clusters. For example rangers, wildlife workers, conservation officers, and nuclear engineers are all related in their concern for our environment. You may want to try other vocational activities from the cluster which contained the first vocation you chose.

I. If you did not find that activity interesting or if it was too difficult to do, you should again look through the index of jobs and find one which appeals to you. Perhaps you should choose this vocational activity from a different cluster also. We trust that you will soon find some vocational activities which you can do successfully, are interesting, and fun. Remember these cluster(s) and vocation(s) for further study.

V. SOURCES OF INFORMATION OUTSIDE THE LAB

Upon completing at least two activity modules relating to a specific career, including the evaluation, gather the following information related to that career:

A. Advantages of that career.

B. Disadvantages of that career.

C. Personal and educational requirements for that career.

D. The relation of demand for people in that career and the supply of qualified persons.

E. Describe the activities a person in that career will most probably do.

F. Be sure to consider working conditions, physical requirements, educational requirements, length of work day, salary, fringe benefits, stability of the job, advancement opportunities, travel required.

To research and gather information for above you are expected to:

1. Ask an expert for the real job story

   a. You should talk to someone who is actually employed doing a job you're interested in to find out what it is really like. Ask around to see if your school has a list of people in the community who will take time to talk to you, either by phone, in person, or by letter.

   b. Arrange an interview, is possible. Perhaps you could also spend some time just being with the person as he works. You would have to be careful to not interfere of course. This would give you a first hand experience of what activities that specific job called for.

c. When you have your interview arranged and know how much time you can have decide if you can discuss the questions or should type them and leave them to be answered at the worker's convenience. Go to meet the person you have contacted, remembering that you are looking for information which may affect your life for many years. Be polite, honest and enjoy yourself. Try to picture yourself in this vocation. Note all impressions and feelings along with the answers to your questions. Write all of this down for future discussion.

2. Consult references found in your classroom and school relating to the career you are investigating. Some references found in most schools are:

Occupational Outlook Handbook

Dictionary of Occupational Titles

Handbook of Job Facts

Encyclopedia of Careers and Vocational Guidance

Career Interest Guide - Northern States Power Company

You are encouraged to answer the following questions relating to a given occupation or cluster. This can be done in writing or in a group discussion.

a. How did you feel about yourself while performing the work?

b. What personal needs do you think would be met or hindered by this work?

c. What talents do you feel you would have for this type of work?

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MODULE: Predicting Seed Germination

CLUSTER: Agri-Business and Natural Resources

OCCUPATIONS: agricultural extension agent

farmer

florist

PRERESUISITES AND PRETEST: (Calculate to the nearest whole number)

1. Be able to calculate what percent of the whole a given fraction is.

   a. 10 is__________% of 25.

   b. 12 our of 48 is________%.

2. Be able to translate percentages into actual amounts for a given value.

   a. 70% of 23,000 is_______. b. 89% of 50 is__________.

3. Be able to calculate the total number in a sample, if a certain % is expressed as a specific number.

   a. 6 is 12% of____________. b. 40 is 60% of___________.

4. Explain in your own words the meaning of the term germination.

OBJECTIVES:

Given the necessary laboratory equipment and a package of seeds, you can:

a. allow the seeds to germinate.

b. calculate the % of the seeds which germinated.

c. predict how many seeds from a larger part of the sample would germinate.

d. predict how many seeds you would plant in each row to assure the germination of a given number of seeds.

EQUIPMENT:

1 package of seeds which will germinate within 2 weeks
moist paper towel or blotter paper
1 petri dish

PROCEDURE:

1. Cut two layers of paper towel or blotter to fit the Petri dish. Saturate

the paper with water and place it into the Petri dish.

2. Put 20 seeds in between the paper layers.
3. Cover the Petri dish and set aside in an undisturbed place at room temperature.
4. Observe the seeds daily, adding water when necessary to keep the paper moist, but being careful not to submerge the seeds. Count and record the total number which have germinated on the chart below.
5. When there is no further germination in at least two days, total up the number of seeds which have germinated.
6. Answer the calculations and predictions asked for below.

DATA AND RESULTS:

Day	Total no. germ.
1	
2	
3	
4	
5	
6	
7	

Day	Total no. germ.
8	
9	
10	
11	
12	
13	
14	

1. What percent of the seeds germinated? Show your work.
2. If you had a package of 600 seeds from this sample, how many would you expect to germinate? Show your work.
3. If you wanted to have 50 seeds in each row plant germinate, how many seeds would you plant per row? Show your work.

EVALUATION: (Show all your work)

1. Show your germinated seeds to your instructor.
2. Out of a package of 80 seeds, 75 germinated.
   a. What percent of the seeds germinated?
   b. Out of 200 seeds from the same sample, how many seeds would you expect to germinate?
   c. How many seeds would you plant per row if you wanted 50 plants per row?

REFERENCE:

Minnesota Department of Education, 4 - 1,
Laboratory Investigations in the Life Sciences for the Junior High School.

TEACHER SUPPLEMENT

MODULE: Predicting Seed Germination

PRETEST:

1. a. 40 b. 25

2. a. 16, 100 b. 45

3. a. 50 b. 67

4. germination - the beginning of growth as from a seed.

EVALUATION:

2. a. 75/80 = .94.8 is 94% or 95%.

   b. .95 x 200 = 190

   c. 95% of x = 50, 95 x = 50, x = 52.6

MODULE: Bacteria in Milk

CLUSTER: Agri-Business and Natural Resources

OCCUPATION: dairy technologist

CLUSTER: Consumer Foods and Homemaking

OCCUPATION: food technologist

PREREQUISITES AND PRETEST:

OBJECTIVES:

Given the necessary equipment you can determine the bacterial content of milk.

EQUIPMENT AND MATERIALS:

several same brand milk samples of different ages - same day as purchase
1 week old
2 weeks old
3 weeks old

(Milk samples should be purchased and refrigerated ahead of time so that on the day you begin the test all milk is cold and of correct ages. Note that each milk carton must have the latest legal date it may be sold imprinted on top. This date may be the most accurate relative age determiner. It will probably be the date 5-7 days ahead of your purchase date)

three test tubes for each kind of sample

water bath at 35° - 45°C

methylene blue solution (Prepare the stock methylene blue solution by dissolving 1.5 grams of the powdered dye in 100 ml of alcohol. For actual use, dilute 1 part stock solution with 9 parts water)

pipet or medicine dropper

sterile cotton

PROCEDURE:

1. Fill separate test tubes 1/3 full with each of the milk samples. Run three samples for each age of milk.
2. Label each tube with date purchased and latest saleable date.
3. Add 1 ml (20 drops) of dilute methylene blue solution to each tube.
4. Plug each tube with sterile cotton and place in the water bath. You may have to turn a hot plate off and on to maintain the correct temperature range during the day.

5. Check the samples periodically. When the milk returns to its normal color record the time that has lapsed on the data table.
6. Rate your milk samples by using the rating chart.

RATING CHART FOR THE QUALITY OF MILK

Time to return to normal color	Quality
Less than 20 mins.	Highly contaminated
20 mins. to 2 hrs.	Poor
2 to 5 1/2 hrs.	Fair
5 1/2 - 8 hrs.	Good
Greater than 8 hrs.	Excellent

DATA AND RESULTS:

DATA TABLE - QUALITY OF MILK			
Sample Identification			
Date Purchased	Latest Saleable Date	Time it took to return to normal color	Quality Rating

EVALUATION:

1. Was there a direct relationship between the age of the milk and its quality?
2. Why do you suppose you were asked to run three samples for milk of each date?
3. What factors other than age do you think would affect the quality of milk? (You may wish to set up another experiment to test one of these factors)

TEACHER SUPPLEMENT

MODULE: Bacteria in Milk

ANSWERS: Evaluation

1. There should be a definite direct relationship between the age of the milk and its quality. The older the milk, the faster the bacteria discolor the blue dye and hence the lower the milk quality.
2. Just one tube of the sample may not give you a true reading. With two tubes of the same sample which may differ, you wouldn't know which tube was characteristic. With three tubes you increase your chances of observing an average reaction which should be exhibited by at least two of the three.
3. Other factors may include temperature, length of time without refrigeration source of the milk, cleanliness of container, dairy producer or brand, etc.

MODULE: Predicting Inherited Characteristics in Animals

CLUSTER: Agri-Business and Natural Resources

OCCUPATION: farmer

CLUSTER: Medicine and Health

OCCUPATION: veterinarian

PREREQUISITES AND PRETEST:

1. An elementary knowledge of genetics.
2. An understanding of the following terms is necessary. Write a brief explanation of each.
   a. dominant trait______________________________
   b. recessive trait______________________________
   c. incomplete dominance__________________________
   d. crossed____________________________________
   e. Punnett square_______________________________

OBJECTIVES:

1. Given the inherited characteristics of a set of animal parents and the parent's parents, and information concerning the dominance or recessiveness of these characteristics, you can,
   a. state what the possible genetic make up is of each parent, each "grandparent".
   b. predict the possibilities of the characteristics in the offspring with the ratio of occurence.
2. Given a wanted inherited characteristic and the characteristics of four possible parents, you can predict which set of parents would be most likely to produce offspring with desired characteristics.

EQUIPMENT:

reference materials on genetics

DATA AND RESULTS:

In the coat color of cattle, black (B) and white (W) are incomplete-dominant. When both genes are present in the same animal (BW), the coat is spotted. The horned condition (H) is determined by another independent set of genes and is dominant over the non-horned condition (h). The bull in this problem, is horned and spotted and was produced by a black and horned male and a white and non-horned female. The cow is spotted and non-horned and was produced by a white and horned male and a black and horned female.

PROCEDURE:

1. Fill in the chart below. Include more than one gene pair combination whenever this is possible.

	Possible gene pairs	
	Coat Color	Horn Condition
a. spotted, horned father		
b. black, horned grandfather		
c. white, non-horned grandmother		
d. spotted, non-horned mother		
e. white, horned grandfather		
f. black, horned grandfather		

2. What are all the possible kinds of offspring from the father and mother as far as color and horns are concerned when these two parents are crossed and in what ratio are they most likely to occur? Work out your results by means of a Punnett square.

EVALUATION:

If you wanted to have the greatest possible chance of producing spotted non-horned offspring (BWhh), which bull and cow would you cross from the following combinations?

Bull #1	Bull #2	Cow #3	Cow #4
BWHh	WWHH	BBhh	BWHh

TEACHER SUPPLEMENT

MODULE: Predicting Inherited Characteristics in Animals

PRETEST:

1. Dominant trait - an inherited trait which is always expressed if it is present.
2. Recessive trait - an inherited trait which is expressed only if a dominant trait for that characteristic is absent.
3. Incomplete dominance - genes for such a trait are neither dominant nor recessive but exert an equal influence with the other trait for a particular characteristic. The results are usually a blend of the two genes if they are not the same.
4. Crossed - mated with.
5. Punnett square - a table or chart used for working out and illustrating genetics problems. The possible male sex cell types are used for headings on the vertical columns; the possible female sex cell types are used for headings on the horizontal columns. The possible resultant offspring are determined in each square of the table by combining the male sex cell at the top of the column with the female sex cell which at the right heads the horizontal column.

PROCEDURE, DATA AND RESULTS:

1.

Possible gene pairs		
	Color Coat	Horned condition
a.	BW	Hh
b.	BB	Hh or HH
c.	WW	hh
d.	BW	hh
e.	WW	hh or Hh
f.	BB	hh or Hh

2. Father = BbHh, Mother = BWhh

	sperm			
	BH	bh	BH	bh
Bh	BBHh	Bbhh	BBhh	BbHh
Bh	BBHh	Bbhh	BBhh	BbHh
Wh	BWHh	hWhh	BWhh	bWHh
Wh	BWHh	hWhh	BWhh	bWHh

Kinds of offspring	Ratio
Black horned	1
Spotted horned	1
Black non-horned	1
Spotted non-horned	1

EVALUATION:

All possibilities to consider are as follows:

Bull #1 (BWHh) crossed with cow #3 (WWHH) are likely to produce:

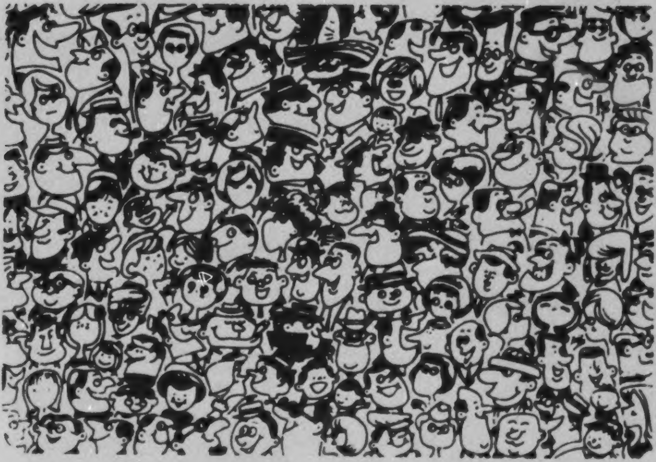
3 out of 16 black and horned
6 out of 16 spotted and horned
3 out of 16 white and horned
2 out of 16 spotted and non-horned
1 out of 16 white and non-horned
1 out of 16 black and non-horned

Bull #2 (WWHH) and cow #3 (BBhh) can only produce spotted and horned offspring.

Bull #2 (WWHHO and Cow #4 (BWHh) are likely to produce:

8 out of 16 spotted and horned
8 out of 16 white and horned

Therefore: Bull #1 and Cow #4 have the greatest possible chance of producing spotted and non-horned offspring.



MODULE: Estimation

CLUSTER: Public Service and
Related Professionals

OCCUPATION: armed forces
astronomer
zoologist

CLUSTER: Environment

OCCUPATION: wildlife manager
wildlife worker

PRETEST AND PREREQUISITES:

1. A knowledge of percent and calculation of percentage error.

   A. What percent of 80 is 4 ______________?

   B. If a student got 4% for the answer to the above question, what is his percent error_________? (% error = $\frac{\text{difference between actual amount and experimental amount} \times 100}{\text{actual amount}}$)

2. Knowledge and skill to weigh accurately with a balance to ± 0.1g.

3. Knowledge of measuring volume using a graduate cylinder.

OBJECTIVES:

1. Given an observable population of the same kind of individual objects, you can estimate the number of individuals in the population within an error of ± 10% and within a given time period.

2. Given an observable population of the same kind of individual objects, you can devise a method for estimating the number of individual objects in the population without counting each individual.

3. Given an observable population be able to estimate the number of individuals of the population thatpossess specific characteristics.

EQUIPMENT:

jar filled with beans

rule or stiff piece of cardboard

balance and weights (± 0. 1g.)

100 ml. graduated cylinder

1 box of nails

People are often asked to make quick estimates of the number of individual objects in a particular group when the time of observation is limited. (Example: less than 10 seconds.) A member of the armed forces may be asked to estimate the number of cartridges in a box, the number of vehicles in a convoy, or the number of buildings in a town. An astronomer may want to estimate the number of visible stars in a galaxy, or craters on a planet. A zoologist or wildlife manager is interested in estimating the number of deer in a herd, or the number of geese in a flock.

PROCEDURE:

1. Obtain a jar filled with beans. Pour out the contents.
2. Quick Guess Method - Take a quick guess of the number of beans in the jar.

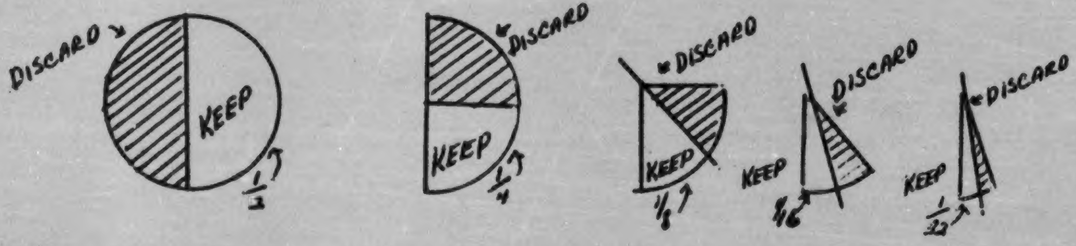
   There are____________in the jar.
3. Relative Masses Method - Find the mass of 10 beans. Find the mass of all the beans using a balance.

   Mass of all of the beans________________g.

   Mass of 10 beans ________________g.

   How many 10 bean masses are there possible in the total mass of all of the beans?

   Estimate the total number of beans__________.
4. Representative Sample Method - Arrange all of the beans into a circle shaped area.



With a rule or piece of cardboard divide the pile of beans in half. Divide that half in half and so forth until you have halved the amount of beans five times. You now have 1/32nd of the original amount of beans. Count the number of beans in this amount.

If this is the amount in 1/32nd of the total, how many beans were there in the original sample?_______________beans.

5. Relative Volume Method - Find the number of beans in a 100 ml. space. Fill a graduated cylinder up to the 100 ml. graduation with beans. Count the beans in this volume. Find the volume of your jar by filling it with water, using a graduated cylinder.

   Estimate the number of beans inthe jar by knowing the number of beans in 100 mls. and the total volume of the jar_________________beans.

6. By actually counting each and every bean after using the estimation methods above, how many beans are there ______________________?

7. Compare the values for the estimations you have made. Which method do you think would be most accurate _______________________? Which is the least accurate_________________?

8. If you had to be extremely accurate in your count how would you find the number of beans in the jar________________?

DATA AND RESULTS;

a. Quick guess:________________beans in the jar.

b. Measuring relative masses:________________in the jar.

c. Measuring a representative sample:___________________beans in the jar.

d. Measuring a relative volume:________________beans in the jar.

Which estimation method gives the most accurate results - b, c, or d?

9. Calculate the percent error of your "quick guess" from your actual count.

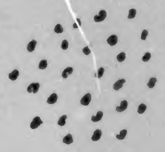
10. Calculate the percent error of the estimation method you think was the most accurate__________.

EVALUATION:

1. Pour out the nails from a box of nails. Estimate the number of nails in the box in 10 seconds. There are_______nails. Count the nails. What was your error?

2. Look around the room. Ask your teacher the approximate number of students in your school building. In 30 seconds estimate the number of students in your school who wear glasses__________.

3. Estimate the number of dots in this cluster in five seconds.



There are______________dots.

Count the dots. Calculate the percent error.

MODULE: Estimation

TEACHER SUPPLEMENT

Students should be able to learn the skill of quick estimation by observing a large population, counting the number of individuals in a small segment of that population, estimating the number of these segments in the total population and multiplying the individuals per segment times the segments per population. This skill can be highly perfected, and used in many occupations for quickly estimating the number in a population or group.

SAMPLE DATA: Quick guess = 400 beans
measuring relative masses estimate - 342 beans

$$\text{percent } \frac{400 - 342}{342} \text{ X } 100 = 11\%$$

ANSWERS TO PRETEST QUESTIONS:

1a) = $\frac{4}{80}$ X 100 = 5% 1b) = $\frac{5-4}{5}$ X 100 = $\frac{1}{5}$ X 100 = 20%

ANSWERS TO EVALUATION QUESTIONS:

1. The student should arrive at an estimate of nails, count accurately the total number of nails, and calculate the percent error.

   $$\text{percent error} = \frac{\text{difference between actual and estimate}}{\text{actual number count}} \text{ X } 100$$

   Error should be around 10%.

2. Student may not be aware of the number of students in the room who wear glasses. He should count them. The teacher's estimate of students in school is generally based on previous knowledge acquired by the teacher. The teacher has not counted them, but relies on other people's estimates. Some students have transferred in; others have left the school population.

3. Student will arrive at approximately 10% error. If student has difficulty, other examples may be given to students (i.e., number of cars in the parking lot, number of brucks in a building wall, etc.).

ADDITIONAL SUGGESTIONS:

Safety Precaution - none

Prerequisite -

1. Students should know how to set up fractions as parts of a whole and from this calculate percent of whole.
2. Students should know how to measure accurately the mass of objects using a balance, and the volume using a graduate cylinder.

MODULE: Mineral Requirements of Plants

CLUSTER: Agri-Business and Natural Resources

OCCUPATION: farmer

florist

PREREQUISITE AND PRETEST:

Be able to weigh out chemicals accurately using a balance.

OBJECTIVES:

1. Given the necessary materials you can test the affects of a lack of certain soil nutrients on the growth of seedlings.
2. Using your lab experiment on soil nutrients and seedling growth, you can identify the variables and controls in the experiment.
3. By comparing the growth of seedlings grown while lacking specific minerals with the growth of seedlings in an actual soil sample, you can suggest which, if any, minerals are lacking in the soil sample.

EQUIPMENT:

Vermuculite

7 - 250 ml. beakers

distilled water

sunny window or "Grow Lux" lamps

bean seeds

corn seeds

sweet pea seeds

ruler

balance

Sach's solution: complete and with various ommissions

Sach's solution - dissolve these salts in one liter of distilled water.

KNO_3 - 1 gm.

NaCl - 0.5 gm.

$CaSO_4$ - 0.5 gm.

$MgSO_4$ - 0.5 gm.

$Ca_3(PO_4)$ - 0.5 gm.

$FeCl_3$ (1% sol'n) trace (1 drop)

Dissolve the above salts in 1 liter of distilled water, omitting the stated mineral and marking the container accordingly.

Sach's solution without sodium

(leave out the $NaCl$)

Sach's solution without magnesium

(leave out the $MgSO_4$)

Sach's solution without phosphate

(leave out the $Ca_3 (PO_4)_2$)

Sach's solution without iron

(leave out the $FeCl_3$)

PROCEDURE:

1. Fill each of 6 - 250 ml. beakers with vermiculite to within one inch of the top. Vermiculite is an inert mineral material which will not nourish seedlings yet provides an excellent environment for plant growth. Place two seeds each of corn, beans, and sweet peas, one inch below the Vermiculite surface in each beaker.
2. Label each beaker by number, place under well lighted conditions, and water each of the seed containers with 100 ml. of one of the following:

Beaker	Solution
1	Complete Sach's solution
2	Sach's solution without sodium
3	Sach's solution without magnesium
4	Sach's solution without phosphate
5	Sach's solution without iron
6	Distilled water

3. The total amount of solution added to each beaker, the temperature, and lighting conditions, etc. should be exactly the same. The only difference should be the kind of solution with which the culture is watered. Add the same amount of each solution to each as often as is necessary to keep the Vermiculite moist. Record the observations asked for on the table below.

DATA AND RESULTS:

	On the 7th day		On the 14th day		On the 21st day	
BEAKER	height (cm)	appearance	height (cm)	appearance	height (cm)	appearance
1 - Complete solution minerals						
2 - no sodium						
3 - no magnesium						
4 - no phosphate						
5 - no iron						
6 - distilled water						
7 - garden soil						

Optional -

4. Plant 2 of each kind of seed in a beaker containing garden soil and treat this culture exactly as the soiless cultures. Water it with an amount of distilled water which is equal to the amounts of solution which you use on the other cultures.

Answer the questions in the following chart:

Question	Corn	Beans	Sweet Peas
1. How does the lack of sodium affect plant height and appearance?			
2. How does the lack of magnesium affect plant height and appearance?			
3. How does the lack of phosphate affect plant height and appearance?			
4. How does the lack of iron affect plant height and appearance?			
5. How does omitting all minerals above affect the plants?			

6. Of all the minerals tested, which one seems:

   a. most essential to healthy plant growth?

   b. least essential to healthy plant growth?

EVALUATION:

1. Name three conditions which were constant in this experiment.

   a. ____________________

   b. ____________________

   c. ____________________

2. Optional - By comparing your data, suggest the condition of the mineral content of the soil used in beaker #7.

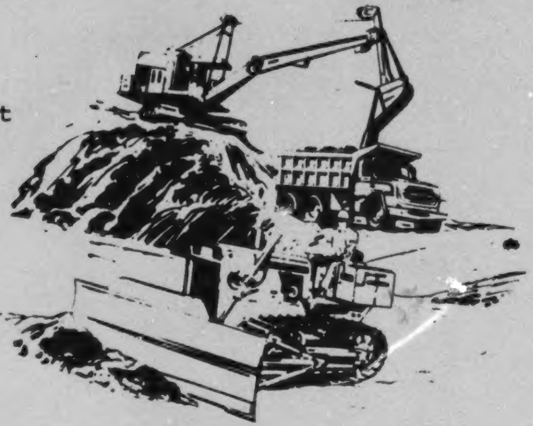
RESOURCE: Morholt, Brandwein, and Joseph, A Sourcebook for the Biological Sciences, Harcourt, Brace, and World, 1966, p. 459.

TEACHER SUPPLEMENT

MODULE: Mineral Requirements of Plants

RESOURCES: Morholt, Brandwein, and Joseph, A Sourcebook for the Biological Sciences, Harcourt, Brace, and World, 1966, p. 459.

MODULE: Soil Testing



CLUSTER: Agri-Business and Natural Resources

OCCUPATION: agricultural extension agent
crop and soil scientist
farmer
florist
geologist

CLUSTER: Environment

OCCUPATION: water management technician

CLUSTER: Public Service

OCCUPATION: lab technician

PREREQUISITES AND PRETEST:

Be able to figure out simple percent problems. Show your work.

a. 65 is ___________% of 80. b. 10 is __________% of 12.

OBJECTIVES:

1. Given the necessary lab materials and three different soil samples. for each sample you can determine:
    a. the pH.
    b. the water holding capacity in %.
    c. the water absorption rate due to capillarity.
2. Using your lab data you can suggest which of the three soils tested would be the most favorable to the growth of plant life and why.
3. Using your lab data, you can state any relation between:
    a. pH and water holding capacity.
    b. water holding capacity and rate of water absorption.

EQUIPMENT:

200 gms. each of dry sandy soil, clay, loam
3 funnels
3 - 100 ml. graduates

6 pieces filter paper

1 roll universal indicator paper

1 balance

3 - 250 ml. beakers

distilled water

PROCEDURE:

Follow the procedure for each of the three samples; sandy soil, clay, and loam, and record your results.

1. Soil pH

   a. Moisten a strip of universal indicator and sprinkle enough soil over it to cover it.

   b. Add a drop or two of distilled water to make it more moist.

   c. Rinse the dirt off the paper and make a color comparison with the pH chart on the tape roll.

   d. Estimate the pH.

2. Water Holding Capacity

   a. Place 100 gm. of dry soil in a filter cone-lined funnel.

   b. Pour 100 ml. of water onto the soil sample and catch the water which drains through the funnel.

   c. After taking the volums of water which drained through in 5 minutes calculate the % of water retained by the soil.

3. Rate of Absorption

   a. Place 100 gms. of dry soil of each sample in a filter cone lined funnel.

   b. Lower each entire funnel stem into a 250 ml. beaker filled with water. Be sure the tip of the soil cone reaches the water.

   c. Rate the absorption speed, with 1 for the fastest soil and 3 for the slowest, after observing for 5 minutes.

DATA AND RESULTS:

	Sandy Soil	Clay	Loam
A. pH			
B. Amt. of water retained			
% held by soil			
C. Relative rate of absorption			

EVALUATION: (Use your lab data to help in answering)

1. Suggest which of the three soils tested would be the most favorable to the growth of plant life and why.

2. What is the relationship between:

   a. pH and water holding capacity?

   b. water holding capacity and rate of water absorption?

RESOURCE: Morhold, Brandwein, and Joseph, A Sourcebook for the Biological Sciences, Harcourt, Brace & World, 1966, p. 522.

MODULE: Soil Testing

TEACHER SUPPLEMENT

PRETEST QUETSIONS:

a. 81% or 81.5%

b. 83% or 83.3%

MODULE: How Does Depth of Seed Planting Affect a Young Plant?

CLUSTER: Agri-Business and Natural Resources

OCCUPATION: farmer

florist

PREREQUISITES AND PRETEST:

Be able to plant seeds and care for plant seedlings.

OBJECTIVES:

1. Given the necessary materials, you can grow seedlings from seeds planted at various depths.
2. After growing the seedlings, you can state the relationship between depth of planting and:
   a. the time it takes for the seedlings to emerge through the soil.
   b. the relative strength of the stem to stand upright.
   c. the above ground height of the plant.
   d. the general appearance of the plant i.e., color of leaves, size of leaves, etc.
3. After the experiment you can suggest the best depth for planting each type of seed you worked with.

EQUIPMENT:

finely divided soil

6 flower pots (at least 4 inches deep)

bean seeds

marigold seeds

water

ruler

sunny window or "Grow Lux" lamp

PROCEDURE:

1. Plant two seeds of each kind in each flower pot (four seeds per pot).
2. In one pot, simply lay the seeds on the soil surface.
3. In another pot, plant each seed 1/4 inch below the surface.

4. In each of four other pots, plant the seeds 1/2 inch, 1 inch, 2 inches, and 3 inches below the surface respectively.

5. Treat all pots the same as to watering, light, temperature, etc. so that the only difference between each pot is the depth at which the seeds were planted.

6. Record the number of days it takes each seedling to emerge from the soil surface.

7. Devise a method of testing the strength of the stem to stand upright. Three weeks after planting, test the stem strength, record the height of each seedling, observe and compare the general appearance of the seedlings with respect to other seedlings of the same species but different planted depths.

Describe the method you used to test the strength of the stem to stand upright.

DATA AND RESULTS:

DEPTH	PLANT	NO. OF DAYS AFTER PLANTING WHEN PLANT ERUPTED THROUGH THE SOIL	HEIGHT AT 3 WEEKS	STEM STRENGTH	GENERAL APPEARANCE
On top	Bean 1				
	2				
	Marigold 1				
	2				

DEPTH	PLANT	NO. OF DAYS AFTER PLANTING WHEN PLANT ERUPTED THROUGH THE SOIL	HEIGHT AT 3 WEEKS	STEM STRENGTH	GENERAL APPEARANCE
1/4"	Bean 1				
	2				
	Marigold 1				
	2				
1/2"	Bean 1				
	2				
	Marigold 1				
	2				
1"	Bean 1				
	2				
	Marigold 1				
	2				
2"	Bean 1				
	2				
	Marigold 1				
	2				
3"	Bean 1				
	2				

DEPTH	PLANT	NO. OF DAYS AFTER PLANTING WHEN PLANT ERUPTED THROUGH THE SOIL	HEIGHT AT 3 WEEKS	STEM STRENGTH	GENERAL APPEARANCE
	Marigold 1				
	2				

EVALUATION: (Consider these items within a given species)

1. What is the relationship between planting depth and the time of emergence through the soil?
2. What is the relationship between planting depth and the relative strength of the stem to stand upright?
3. What is the relationship between planting depth and the above ground height of the plant 3 weeks after planting?
4. What is the relationship between planting depth and general appearance of the seedlings?
5. What would you recommend as the best planting depth for:

    a. beans? __________

    b. marigolds __________

MODULE: How Does Depth of Seed Planting Affect a Young Plant?

TEACHER SUPPLEMENT

PROCEDURE:

#7. Since testing the stem strength is done at the end of this activity, methods can be used which will result in the destruction of the plant Some possible methods are:

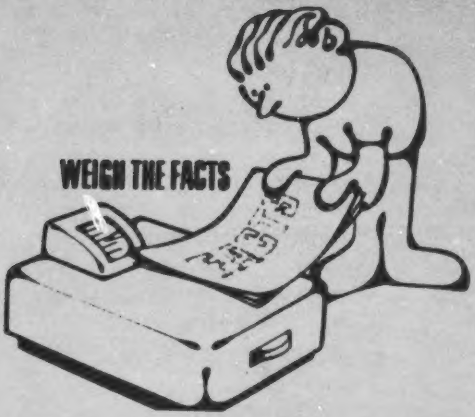
a. Attach the hook of a spring scale which is in a horizontal position to the stem at a given distance above the soil and pull horizonatlly until you lose tension on the hook. Record the highest force in grams which was registered on the scale during this operation. Compare the maximum forces among the various plants.

b. Set the flower pot on its side so that the plant is horizontal. Hook a paper clip on the stem at a given distance. Continue to hang paper clips onto the original clip until the stem breaks, becomes uprooted, etc. Record the number of paper clips needed to break or uproot each plant stem.

MODULE: Can you Defend Your Client?

CLUSTER: Business and Office

OCCUPATION: lawyer



PREREQUISITES:

You must be able to research the literature on a given topic.

OBJECTIVES:

Given an accusation against your client, for which he will be tried in court, you can:

- a. locate and state the main points of law which apply to this case.
- b. anticipate and state the evidence and arguments which could be used against your client.
- c. present evidence and the arguments which you can use to defend your client.

EQUIPMENT: library

sources of local, state and federal laws

PROCEDURE:

1. Suppose you are a lawyer and a client of yours is accused of one of the following for which he will be tried in court:
    - a. violating the no outdoor burning law.
    - b. owning a dog which is a public nuisance.
    - c. polluting the lake by using weed killer on his beach.
    - d. owning and driving a truck which emits pollutants greater than the accepted standards.
    - e. hunting and taking a protected species of animal.
2. Choose one of the five accusations and research the laws and literature on the subject.
3. Briefly state the laws which come to bear on the case.
4. Anticipate and state the evidence and arguments which could be used against your client.

5. Present evidence and the arguments which you could use to defend your client.

6. Be sure to back up the arguments on each side of the question with data.

DATA AND RESULTS;

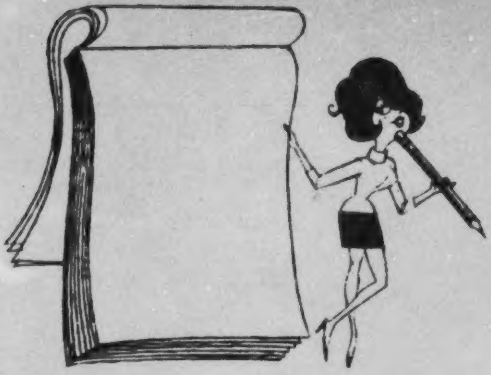
Write up your findings and arguments and present them for consideration to your instructor as well as five of your classmates.

EVALUATION:

Ask your instructor and classmates to each come to a decision as to whether you have proved your client to be guilty or not guilty of the original accusation.

TEACHER SUPPLEMENT

MODULE: Can You Defend Your Client?



MODULE: Developing a Desk Book of Standard Operating Procedures

CLUSTER: Business and Office

OCCUPATION: secretary

stenographer

typist

receptionist and switchboard operator

PREREQUISITES AND PRETEST:

OBJECTIVES: You can organize a task efficiently, and record the procedure that should be followed.

EQUIPMENT:

paper and pencil

PROCEDURE:

One of the most important parts of a secretary's job is being efficient and very well organized. It is also important that this efficiency and organization be carried on when the secretary is absent. This is why it is important for a secretary to maintain a "desk book". This book lists her many duties and gives descriptions of the procedures that each job requires. The duties and procedures of a secretary's job are constantly changing but if kept up to date a good "desk book" will allow anyone to take over the job at a moment's notice without the o office loosing much of its efficiency and organization.

1. Select an activity that you have done in the past and that you plan to do in the future. Suggestions: washing the car, washing the dishes, giving a party, getting ready to go somewhere, doing your homework, preparing a meal, maintaining your bicycle, etc.
2. Make a list of things that have to be done for that activity on the back of this sheet. Be careful not to leave anything out.

3. Take a good look at this list and put them in order. Number the steps.

4. On a separate piece of paper, write a procedure for each of the things on your list. Example: For giving a party, one item on your list might be "inviting friends".

   The procedure could be something like this:

INVITING FRIENDS

MATERIALS:

Address book
Pencil and paper
Telephone

PROCEDURE:

1. Go through the address book and decide who should be invited. Make a list of their names and telephone numbers.
2. Starting at the top of the list call each name asking them to come to the party.
3. After each name make one of the following notations:

   NH - Not home, call back
   NS - Not sure, call back
   Y - Yes
   N - No
   M - Maybe

4. When you are finished count the number of Y's to see if you have to invite more. If you need more people for your party either go back to the address book for more names or ask your guests to invite some of their friends.

5. Try it out, see if it is an efficient way of doing things. Make any changes that you see that are necessary. Even to the extent of throwing it out and starting over.

DATA AND RESULTS:

List the steps required for the performance of the activities on the back of this sheet. Number them in the proper sequence.

EVALUATION:

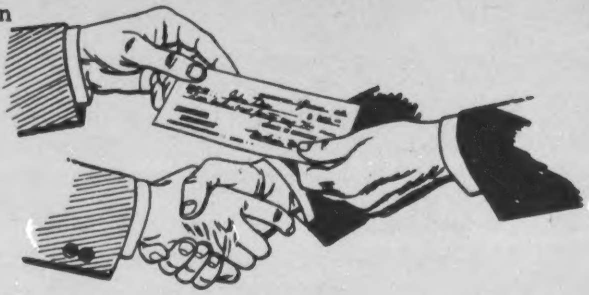
1. Did you find that you were doing things in an inefficient way? How did you change your procedure to make it more efficient?
2. Do you think some one else could follow your procedure?

TEACHER SUPPLEMENT

MODULE: Developing a Desk Book of Standard Operating Procedures

52A

MODULE: Use of Signatures for Identification



CLUSTER: Marketing and Distribution

OCCUPATION: cashier

CLUSTER: Business and Office

OCCUPATION: bank clerk

PREREQUISITES AND PRETEST:

OBJECTIVES: You can describe some of the problems of using signatures for the purpose of identification.

EQUIPMENT:

pencil

piece of paper

PROCEDURE A:

1. Write your signature in the blank below.

Signature:____

2. Look in your billfold and find any cards or pieces of paper that you have signed. If possible, find a signature that you have written recently, one made a year ago and one made several years ago.

DATA AND RESULTS:

1. Is your signature above identical with the signature that you have made recently?
2. Has your signature changed during the past year? During the past several years?

PROCEDURE B:

1. Have two other friends sign on the spaces provided under DATA AND RESULTS.
2. Try to copy their signature. (You may want to try to trace the signatures as well as copy them freehand)

DATA AND RESULTS:

Signature #1____________________

Copy 1____________________

2____________________

3____________________

4____________________

Signature #2____________________

Copy 1____________________

2____________________

3____________________

4____________________

Signature #3____________________

Copy 1____________________

2____________________

3____________________

4____________________

EVALUATION:

1. Is the signature a perfect form of identification? Explain.

2. Since every signature that a person makes is slightly different, what specific things about a signature can you use for identification?

3. What other form of proof should be used for personal identification?

4. How easy is it to forge someone's signature?

5. Are some types of signatures easier to duplicate than others?

6. If a customer has the proper identification can you be sure that the check he is cashing is good?

Why or why not?

MODULE: Use of Signatures for Identification

TEACHER SUPPLEMENT

ANSWERS:

EVALUATION:

1. No, a person's signature is always changing and many signatures can be easily forged by a professional.
2. Certain letters might be repeated constantly.
3. A picture on the back of some type of official identification card.

MODULE: Cross Reference for Telephone Numbers

CLUSTER: Business and Office

OCCUPATION: receptionist & switchboard operator

secretary

typist

PREREQUISITES AND PRETEST:

OBJECTIVES: You can develop a cross reference system for your friend's and business telephone numbers.

EQUIPMENT:

file cards

pencils

your own address & telephone book (If you don't have one, make a list right now of names, addresses and numbers. The cards you make from it in this module should be helpful to you in the near future)

PROCEDURE:

Many times a secretary will find that a simple alphabetical listing of telephone numbers is not sufficient for doing the job efficiently. For instance, your first day on the job your supervisor may walk by your desk and say "call Joe and tell him that I'm on my way". Before you can question him about "Joe who?" he is gone. You have the problem of finding out who Joe is and what his number is. If this was a general procedure on the part of this supervisor, the secretary that had the job before you should have set up a cross reference system for telephone numbers. All you have to do is look in the file cards for "Joe". Maybe you have already had such an experience. Perhaps you have met someone on a trip. You put her name in your address book but you can't remember her last name. All you remember is her first name and where you met her.

A cross reference system including first names and places would be helpful. Try creating a cross reference system for your address and telephone book.

1. For each name in your address book write an index card, using last name first, including telephone number (business and home) and address (business and home.)

Johnson, Joe N. Home 484-6324 Business 488-5162

421 Jersy Avenue No.
St. Paul, Minn. 55104

Super Paper Company
2484 N. Roll Street
St. Paul, Minn. 55117

2. Make a second card.

To make this second card:

Think of one thing that you can remember about this person. (First name, place where he lives, what he does, where you met him, etc.)

Joe N. Johnson 837-5162

421 Jersy Avenue No.
St. Paul, Minn. 55104

or

St. Paul, Minn. 837-5162

Johnson, Joe N.
421 Jersy Avenue No.
St. Paul, Minn. 55104

or

Hockey

Johnson, Joe N. 837-5162
421 Jersy Avenue No.
St. Paul, Minn. 55104

3. Put all cards in alphabetical order according to the top line of the cards.
4. When you have finished you should have a cross index card system for your addresses and telephone numbers.

DATA AND RESULTS:

1. Did you find a lot of names on your list that you had forgotten about?
2. Do you think this new system will help you remember from now on?
3. Bring the cards home and use them.

TEACHER SUPPLEMENT

MODULE: Cross Reference for Telephone Numbers

MODULE: Filing System I

CLUSTER: Business and Office

OCCUPATION: secretary
file clerk
clerk-correspondent

PRETEST:

OBJECTIVES: You can use a filing system designed to meet a specific office need.

MATERIALS:

20 letters, incoming and copies of outgoing

PROCEDURE A:

1. Cut out the letters at the end of this activity.
2. Sort the letters into stacks that have meaning to you. In other words, group the letters together that you think have something in common. Try to have at least 3 or 4 stacks.
3. What do the letters in each stack have in common which makes them different from the letters in the other stacks?

a.________________________________ b.________________________________

c.________________________________ d.________________________________

DATA AND RESULTS:

PROCEDURE B:

Try to file the 20 letters by using the Classification of Letters Key.

This is how it works:

INSTRUCTIONS: For using the Classification of Letters Key -

a. Take a look at the Key. Notice that there is a series of numbered choices on the left side. On the right side are either choice numbers or file numbers.
b. Start with choice 1 and move down the series.
c. If the choice of characteristics leads to a number such as choice 8, you must skip down to 8a or 8b.

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d. When the choice leads to a file number, you have found the classification of that letter.

CLASSIFICATION OF LETTERS KEY

CHOICE	CHARACTERISTIC	MOVE TO CHOICE
1a	The letter is outgoing	2
1b	The letter is incoming	8
1a	The letter is a request	3
2b	The letter provides information	5
3a	The letter is a request concerning money	FILE NUMBER 101
3b	The letter is a request concerning merchandise	4
4a	A request for merchandise (an order)	FILE NUMBER 201
4b	A request for information about merchandise	FILE NUMBER 202
4c	A request for information about a service	FILE NUMBER 203
5a	Provides information about merchandise	6
5b	Provides information about a service	7
5c	Provides information about money	FILE NUMBER 101
6a	Provides information requested	FILE NUMBER 301
6b	Provides information not requested	FILE NUMBER 302
7a	Provides information requested	FILE NUMBER 401
7b	Provides information not requested	FILE NUMBER 402
8a	The letter is a request	9
8b	The letter provides information	11
9a	The letter is a request concerning money	FILE NUMBER 111
9b	The letter is a request concerning merchandise	10

CHOICE	CHARACTERISTIC	MOVE TO CHOICE
10a	A request for merchandise (an order)	FILE NUMBER 211
10b	A request for information about merchandise	FILE NUMBER 212
10c	A request for information about a service	FILE NUMBER 213
11a	Provide information about merchandise	12
11b	Provide information about a service	13
11c	Provide information about money	FILE NUMBER 111
12a	Provide information requested	FILE NUMBER 311
12b	Provide information not requested	FILE NUMBER 312
13a	Provide information requested	FILE NUMBER 411
13b	Provide information not requested	FILE NUMBER 412

MODULE: Filing System I & II

National Rubber Bumper Company
36 Cushion Drive
Mount Curve, Washington

March 12, 1972

Carmen Jones
Vice President - Produce Research
Clean Sweep Vacuum Company
Brooming, Wisconsin

Subject: Information requested on "Pro-Tex-All" line of rubber bumpers

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National Rubber Bumper Company
36 Cushion Drive
Mount Curve, Washington

February 16, 1972

Robert Nathon
Vice President - Sales
Rubber Tree Company
Stretch Ville, Massachusetts

Subject: Order for Rubber-Flex

Clean Sweep Vacuum Company
Brooming, Wisconsin

February 28, 1972

John Heimer
Research Engineer
National Rubber Bumper Company
Mount Curve, Washington

Subject: Request ten samples of the "Pro-Tex-All" rubber bumpers.

Rubber Tree Company
Streach Ville, Massachusetts

February 28, 1972

John Heimer
Research Engineer
National Rubber Bumper Company
Mount Curve, Washington

Subject: Announcement of a new produce.

Rubber Tree Company
Streach Ville, Massachusetts

February 26, 1972

John Heimer
Research Engineer
National Rubber Bumper Company
Mount Curve, Washington

Subject: Payment must accompany orders for Rubber-Flex.

Clean Sweep Vacuum Company
Brooming, Wisconsin

May 25, 1972

John Heimer
Research Engineer
National Rubber Bumper Company
Mount Curve, Washington

Subject: Request waver of payment for samples of "Pro-Tex-All" bumpers in exchange for test results.

National Rubber Bumper Company
36 Cushion Drive
Mount Curve, Washington

January 10, 1972

J. M. Carver
Chief Research Scientist
Testing Labs, Inc.
Smokey Valley, California

Subject: Request for information about the testing services available.

National Rubber Bumper Company
36 Cushion Drive
Mount Curve, Washington

January 26, 1972

Robert Nathon
Vice President - Sales
Rubber Tree Company
Streach Ville, Massachusetts

Subject: Request for information about your new product - Rubber-Flex.

MODULE: Filing System I & II

National Rubber Bumper Company
36 Cushion Drive
Mount Curve, Washington

April 30, 1972

Carmen Jones
Vice President - Product Research
Clean Sweep Vacuum Company
Brooming, Wisconsin

Subject: Request for test results on the "Pro-Tex-All" rubber bumpers.

Rubber Tree Company
Streach Ville, Massachusetts

February 6, 1972

John Heimer
Research Engineer
National Rubber Bumper Company
Mount Curve, Washington

Subject: Information that you requested about Rubber-Flex.

National Rubber Bumper Company
36 Cushion Drive
Mount Curve, Washington

March 25, 1972

J. M. Carver
Chief Research Scientist
Testing Labs, Inc.
Smokey Valley, California

Subject: Technical information on the "Pro-Tex-All" rubber bumpers as requested.

Clean Sweep Vacuum Company
Brooming, Wisconsin

March 3, 1972

John Heimer
Research Engineer
National Rubber Bumper Company
Mount Curve, Washington

Subject: Request information on your experimental "Pro-Tex-All" line of rubber bumpers.

MODULE: Filing System I & II

Testing Labs, Inc.
Smokey Valley, California

January 20, 1972

John Heimer
Research Engineer
National Rubber Bumper Company
Mount Curve, Washington

Subject: Information requested about the testing services that are available.

National Rubber Bumper Company
36 Cushion Drive
Mount Curve, Washington

June 14, 1972

Carmen Jones
Vice President - Product Research
Clean Sweep Vacuum Company
Brooming, Wisconsin

Subject: New technical data on the "Pro-Tex-All" rubber bumpers for your information.

Testing Lab, Inc.
Smokey Valley, California

March 12, 1972

John Heimer
Research Engineer
National Rubber Bumper Company
Mount Curve, Washington

Subject: Request technical information on the "Pro-Tex-All" rubber bumpers.

National Rubber Bumper Company
36 Cushion Drive
Mount Curve, Washington

April 15, 1972

Robert Nathon
Vice President - Sales
Rubber Tree Company
Streach Ville, Massachusetts

Subject: "Rubber-Flex" meet our purpose well.

MODULE: Filing System I & II

Clean Sweep Vacuum Company
Brooming, Wisconsin

June 15, 1972

John Heimer
Research Engineer
National Rubber Bumper Company
Mount Curve, Washington

Subject: Payment for samples of "Pro-Tex-All" bumpers.

National Rubber Bumper Company
36 Cushion Drive
Mount Curve, Washington

June 5, 1972

Carmen Jones
Vice President - Product Research
Clean Sweep Vacuum Company
Brooming, Wisconsin

Subject: Waiver of payment not approved.

Clean Sweep Vacuum Company
Brooming, Wisconsin

June 20, 1972

John Heimer
Research Engineer
National Rubber Bumper Company
Mount Curve, Washington

Subject: Test results on the "Pro-Tex-All" rubber bumpers as requested.

National Rubber Bumper Company
36 Cushion Drive
Mount Curve, Washington

May 15, 1972

Carmen Jones
Vice President - Product Research
Clean Sweep Vacuum Company
Brooming, Wisconsin

Subject: Request payment for samples of "Pro-Tex-All" rubber bumpers.

TEACHER SUPPLEMENT

MODULE: Filing System I

67A

MODULE: Filing System II
Design Your Own Filing System

CLUSTER: Business and Office

OCCUPATION:
- secretary
- file clerk
- correspondent

PREREQUISITES AND PRETEST: Module: Filing System I

OBJECTIVES: Given the criteria, the student can set up a filing system including a filing key.

EQUIPMENT - MATERIALS:

- the 20 letters used in Filing System I
- paper, pencil

PROCEDURE:

Your boss would like to change the filing system used in your office. The old system is the one that is indicated by the classification of Letters Key in Module: Filing System I. The old filing system should be changed as follows:

a. the files concerning money should remain the same.

b. all other letters should be grouped according to the type of merchandise mentioned.

c. develop a key for your filing system.

DATA AND RESULTS:

1. What letters did you find hard to file?
   What did you do with them? How did you change the system so that you could file them correctly?
2. Is this system more confusing or less confusing than the old system?
   What would you recommend to your boss?
3. Hand the kay and your recommendations to your teacher.

TEACHER SUPPLEMENT

MODULE: Filing System II
Design Your Own filing System

68A

MODULE: Broadcast Item Recording and Playback

CLUSTER: Communications and Media

OCCUPATION: broadcasting technician

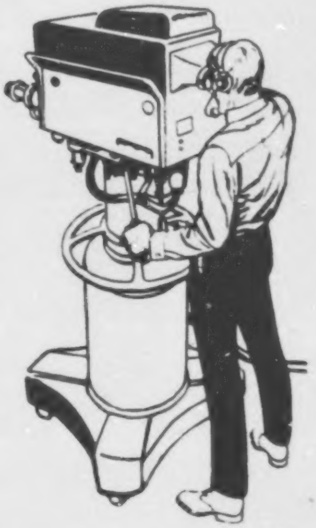
PREREQUISITES AND PRETEST:

Ability to set up and operate a tape deck, cassette system, video-audio tape system, movie camera and projector and P.A. system.

OPTIONAL PREREQUISITE:

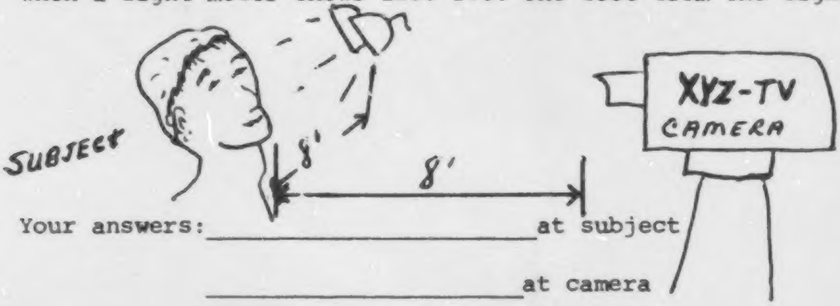
Ability to calculate illumination given a light meter and yardstick, knowing that

$$\text{illumination} = \frac{\text{footcandles 1 unit distance from source}}{(\text{distance units from source})^2}$$



OPTIONAL PRETEST:

Calculate the number of footcandles received at the subject, and at the camera reflected from the subject when a light meter shows 1280 f.c. one foot from the lights:



Your answers: ____________________ at subject

____________________ at camera

Note: Correct answers are on the following page in the equipment section.

Note: Light meter readings may be made at the camera to eliminate the calculations. Point the light meter at the subject and read the reflected footcandles.

OBJECTIVES:

1. Given the necessary equipment you can:
   a. set up the equipment to record and/or amplify a presentation.
   b. play back the presentation at a set time.

While a presentation is beginning and in progress you can use appropriate hand signals to cause an announcer or performer:

a. start or stop

b. speed up or slow down

c. move closer or farther from the microphone

d. increase or decrease volume

e. know the time remaining in the program

2. To prepare for a filming or video taping you can, using a light meter, arrange suitable lighting to meet given illumination requirements (see Module: How Bright are You? Lighting Design) on subjects and objects.

EQUIPMENT:

Note: It is not necessary to have all of the listed equipment to satisfactorily do the activity.

tape deck
cassette system
P. A. system
portable lights
video tape system
movie equipment
light meter

ANSWERS: 20 f.c. at subject
5 f.c. at camera

PROCEDURE:

1. Decide on some school event, class or small group presentation, or some activity of your own to record. Perhaps a journalism group of some students who want to act could provide a short program. A definite time limit should be set for the program. You may record it sound only, sight only, or combine both, depending on the availability of equipment.

2. Set up and check out the equipment well before the recording time. Make sure that you ask for help and directions in using any piece of equipment you are not sure you can operate perfectly.

3. If you are making a movie or video tape check the light falling where the subject will be (direct light) and the light received by the camera (reflected light). To check the light received by the camera you stand at the camera and point the light meter at the spot where the subject(s) will be. There must be someone or something similar to the subject(s) to reflect light toward the camera. The camera should receive 10 - 30 footcandles from the subject.
4. If you are recording speaking or singing, both the performers and the director-recorder (you) must know the silent hand signals. These are included at the end of the module. Learn these together and be able to use them during the performance. Practice them together during rehearsal before the actual recording.
5. Record the presentation and schedule a playback time. You must have everything ready to start and complete playback at exactly the correct time.

   Note: Now that you, and perhaps several other students, have become somewhat experts in using recording equipment you may form a recording technicians club to assist classes and teams in school in recording their activities.

DATA AND RESULTS:

You might write a paragraph giving some guidelines you found helpful in setting up and using recording equipment. Include information like: number of lights used, distance from lights to subject and subject to camera or microphones, number of microphones used, location of equipment and props in the school, where 3 wire adapters are needed, etc. This information would be valuable and time saving for the next recording session.

EVALUATION:

1. Present your recording to the subjects for their evaluation. Have them answer questions such as:

a. is the audio (sound) level correct? (If not, how could you correct it?)

b. is there balance in the sound between voice parts or between various speakers? (If not, how could you correct it?)

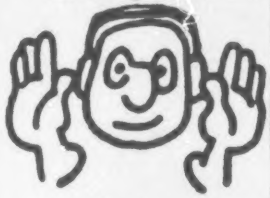
c. does the picture show everything that was important to see? (If not, how could this be corrected?)

2. Make or be able to make corrections to improve the presentation as suggested by the question answers.

MODULE: Broadcast Item Recording and Playback

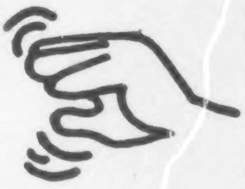
PERFORMANCE CUE HAND SIGNALS

Getting started.

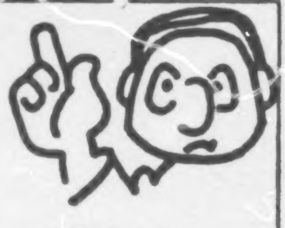


ALERT!
For whole studio
Near air time

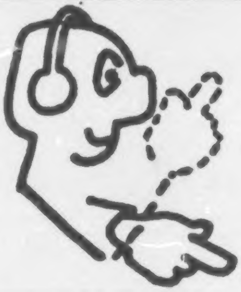
Audio Check



TALK!
imitate wagging jaws

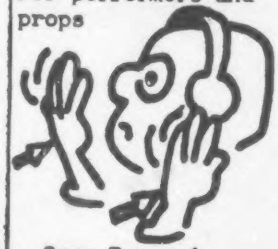


READY CUE
For first speaker
in any given episode

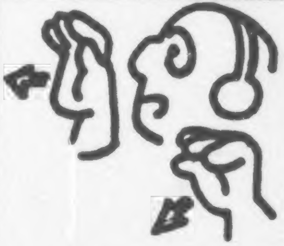


YOU'RE ON!

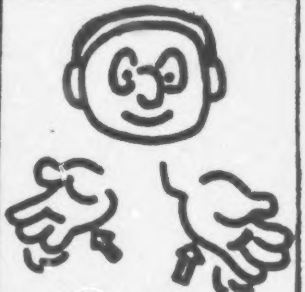
POSITION CHANGES
For performers and
props



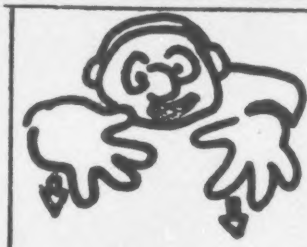
Come Forward



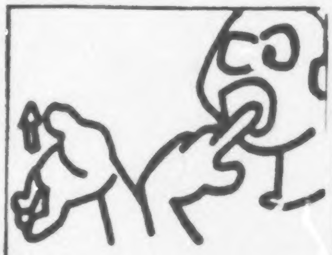
Move Back



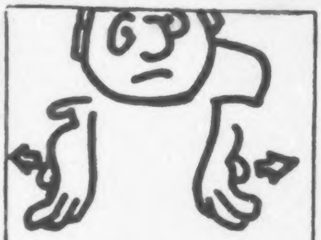
Stand Up
(palms up)



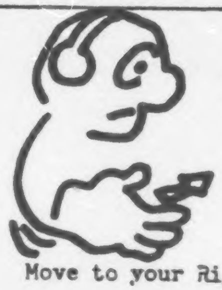
Sit Down



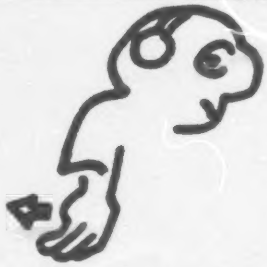
SPEAK LOUDER



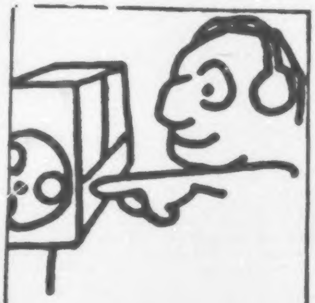
Move Apart
(palms out)



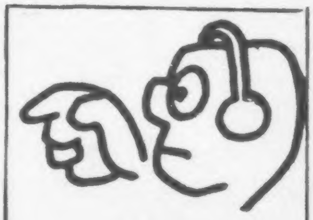
Move to your Right



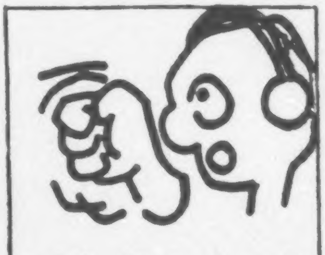
Move to your left



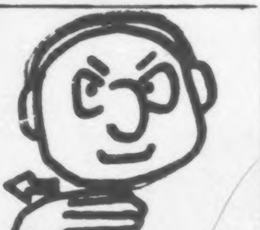
Play to this
camera.



slowly form fist--
3 seconds



shake fist rigorously
for last 3 seconds



CUT!

MODULE: Broadcast Item Recording and Playback

TEACHER SUPPLEMENT

PRETEST PROBLEM:

$$\text{illumination in footcandles} = \frac{\text{illumination one unit distance from source}}{(\text{number of unit distances from source})^2}$$

$$\text{illumination at subject} = \frac{1280 \text{ f.c.}}{8^2} = \frac{1280}{64} = 20 \text{ f.c.}$$

$$\text{illumination at camera*} = \frac{20 \text{ f.c.}}{22} = \frac{20 \text{ f.c.}}{4} = 5 \text{ f.c.}$$

*The light is actually traveling twice as far to the camera as to the subject so the distance to the subject becomes one unit of distance and distance to the camera becomes two units of distance.

ANSWERS TO QUESTIONS:

1. a. The audio could be corrected by moving microphones, having speakers talk louder, softer, or face the mike if it is not omni-directional, reduce background noise if it is a problem, etc.

   b. Often the lower voices in singing groups need greater amplification than higher voices. Microphone placement when recording bands, orchestras, debates, etc., must be checked out carefully.

   c. Decide what is the most important part of each scene and make sure that it is photographed, even to the exclusion of other things.

2. The production may be reduced or expanded by writing sections for deletion or expansion before the presentation. Cue signals should be made to alert the performers to cut and finish or to add to their presentation.

MODULE: Ink and Paint Drying Time and Finish Permanence

CLUSTER: Communications and Media

OCCUOATION: commercial artist and cartoonist

PRETEST:

OBJECTIVES:

1. Given various liquid drawing materials such as ball point, India ink, oil or water paint, you can:
    a. estimate the time when the wet material is dry enough to touch without smudging.
    b. estimate what effect various weather conditions will have on drying time.
2. Given various drawing materials you can make sketches with them and then, using the correct products and techniques, finish the dry surface so that it is smudge proof and will not dull.

EQUIPMENT:

artist's drawing paper

chalk

pencil

charcoal

ball pen

water colors

surface finishing materials

tempera

oil base paint

appropriate brushes

oil paint thinner-cleaner

India ink and pen (Speed Ball if available)

Tuffilm Varnish Spray*
Del-Fix*
Fixatif* (needs atomizer)
Krylon*

Note: hair spray may be substituted for the preservative sprays.

*available at art supply and stationery store.

PROCEDURE:

1. Cut a sheet of drawing paper into eight equal parts.

2. Make a mark on one piece of paper with one of the drawing materials and record the time in seconds, minutes, hours, or days, it takes for the mark to dry and not come off on your finger. Repeat this procedure for each drawing material you have.

3. Record these times in the data table.

OPTIONAL:

You might experiment to find ways to make the mark dry faster.

4. Using as many of the mentioned drawing materials as you can find, make small finished drawings of a subject that interests you. Make the five-eight drawings all of the same subject and size but you may perhaps change the view or position.

5. Check with your teacher to be sure he has the preservative you will need. You should check with a local art supply store in person or by phone to find what products are used to cover the drawings.

6. Carefully apply a finishing material to your drawings. Record in the data table the time you apply the finish and the time it is completely dry and the drawing is ready for handling.

7. Try to smudge your drawings and record your findings in Table Two.

8. Place the drawings in sunlight and record any bleaching or color changes you notice over several days.

9. If you have time, try another preservative spray on a second set of drawings, or check with your teacher to see if another student has done or will do this activity and use a different spray. Compare the results.

OPTIONAL:

Try hair spray as a preservative and compare results.

DATA AND RESULTS:

DRYING TIME AND PERFORMANCE

Drawing Med.	Time Dry	Time Appl.	Drying Time	Preservative Used	Time Dry	Time Appl.	Drying Time	Protective Ability Smudge, Bleaching, etc.
1. Ball pen								
2. Water color								
3. Tempera								
4. India ink								
5. Oil paint								
6. Chalk								
7. Charcoal								
8. Pencil								
9.								
10.								

EVALUATION:

1. Why is knowing the drying time of inks and paints important to an artist?
2. Why would you expect a watercolor to dry more slowly outside in Houston, Texas, than in Phoenix, Arizona, when the temperature is 90° in both cities?
3. What is the purpose of using a preservative spray?
4. How do you think a preservative spray works?
5. Which painting medium takes the longest to dry?
6. List an advantage and disadvantage of quick drying drawing materials.

MODULE: Ink and Paint Drying Time and Finish Performance

TEACHER SUPPLEMENT

ANSWERS TO QUESTIONS:

1. A drawing could be ruined or need extensive redoing if part of it were smudged as a result of touching it before it was dry.
2. The humidity in Houston is greater than in Phoenix so drying would be slower there.
3. Preservative sprays protect the drawings from smudging and dulling from oils and chemicals found on the hands and moisture.
4. The spray coats the pictures with thin transparent film which is touched instead of the actual art work.
5. Oil, depending on the thickness of application, takes the longest to dry. Some paintings never completely dry because the tough surface film stops the complete evaporation of the pigment carriers.
6. Quick drying materials have the advantage that the entire picture is almost constantly workable. A disadvantage may be the permanence of an error and slight cracking or curling of the paper.

MODULE: How Bright Are You?
Lighting Design

CLUSTER: Communications & Media

OCCUPATION: photographer

broadcast technician

CLUSTER: Construction & Repair

OCCUPATION: architect

PREREQUISITES:

Ability to use a light meter and set up lights.

OBJECTIVES:

1. Given a lighting requirement in footcandles or lumens, a light meter, and a measuring tape you can:
    a. calculate the candlepower or lumens needed to supply the correct amount of illumination at a given distance between lamps and surface.
    b. decide how many lamps of the incandescent or fluorescent type are needed.
    c. check your calculations by actual test.
2. Given a light meter which doesn't work you could suggest several things which could be wrong with it.

EQUIPMENT:

footcandle light meter or photographic light meter (use the chart included in this module to correct to footcandles)

measuring stick or tape

lamps and sockets

NOTE: Your local power company, General Electric, Westinghouse and Sylvania may prove helpful.

PROCEDURE:

General Information.

1. If your light meter does not read in footcandles complete the following procedure and table. If your light meter does read in footcandles go on to 2.

   A. Set the ASA reading on your light meter at ASA 100.

   B. Line up f/2.8 with shutter speed 1/15 second.

   C. Note the light intensity number which corresponds to these two values and record it in the conversion table.

   Note: When using a light meter which is calibrated for reflected light you must take your readings from the surface, not the source.

FOOTCANDLE CONVERSION TABLE

f stop	shutter speed	intensity number	footcandles at meter
2.8	1/15		2
2.8	1/30		3
2.8	1/60		7
2.8	1/125		13
2.8	1/250		27
2.8	1/500		53
16	1/30		107
16	1/60		213

2. G. E. (General Electric) Lumen Counter Method of lighting

   A. A lumen is the amount of light falling on a one square foot spherical area one foot from the light source. It is the actual light output of the lamp.

   Note: The Lumen Counter Method is produced by General Electric Co., Inc.

B. Here is a suggested minimum number of lumens for some lighting situations:

LIGHTING RECOMMENDATIONS IN LUMENS PER SQUARE FOOT OF FLOOR SPACE

Location	Lumens	Location	Lumens
Living Room	80	Bedroom	70
Dining Room	45	Hallway	45
Kitchen	80	Laundry	70
Bathroom	65	Work Bench	70

C. Measure the length and width of floor space and multiply them to find the area in square feet.

D. Multiply the area you've just calculated by the number of lumens each square foot should have to find the total number of lumens the room or hall should have.

E. Now check the lumen output of the following lamps and choose enough lamps to supply the needed amount of illumination. For example; if your bedroom should have 70 lumens/ft.^{2} and its dimensions are 10' x 12', you need 70 x 120 or 8400 lumens in your room. You then add lamps to achieve this amount.

LUMEN OUTPUT OF COMMON LAMPS

Lamp Type	Wattage	Lumens
Incandescent	------	------
frosted bulb	60	855
frosted bulb	75	1180
frosted bulb	100	1750
3-way bulb	30-70-100	280-910-1190
3-way bulb	50-100-150	580-1670-2250

Lamp Type	Wattage	Lumens
Fluorescent	---	---
warm white 15"	14	460
warm white 18"	15	505
warm white 24"	20	820
warm white 33"	25	1320
warm white 36"	30	1480
warm white 48"	40	2180
warm white 96"	75	5800
Flood lights	---	---
spot lights	50	430
spot or flood	75	860
spot or flood	150	1950
reflector flood	1000	24,000

Note: The lumen output is reduced if the lamps are colored as follows:

Incandescent bulbs - pink = 75% of rated lumens
blue = 40% of rated lumens

Spot and flood lights - yellow = 80% of rated lumens
amber = 55% of rated lumens
pink = 50% of rated lumens
blue = 35% of rated lumens

Note: Cool white fluorescent lamps have about the same lumen rating as warm white.

F. It is important to note that many factors affect the actual effective lighting received from a lamp. The reflective ability of the room surfaces, the distance between lighted surface and lamp, shading, indirect lighting, and angle of incidence are some variables which should be considered. The lumen values in the table are for ideal direct lighting situations. If indirect lighting is used lighting engineers suggest doubling the lumens.

3. Candlepower - Footcandle Method of lighting

   A. Candlepower is similar to lumen rating except that it is measured in a specific direction and decreases as the angle moves away from straight out (90%) from the source.

   B. Footcandle is a measure of the light falling on a surface and decreases by the square of the distance (in feet) away from the source. For example; if the candlepower rating of a lamp were 1000 and the surface to be lighted were 10 feet away - we could find the illumination falling on the surface this way:

$$\text{footcandles on surface} = \frac{\text{candlepower of lamp}}{(\text{feet between lamp and surface})^2}$$

$$= \frac{1000 \text{ c.p.}}{(10 \text{ ft.})^2} \qquad = \qquad \frac{1000 \text{ c.p.}}{(100 \text{ ft.})^2}$$

illumination on surface = 10 footcandles

   C. Since both lumens and candlepower are measures of light one foot away from the source and covering a one square foot area we can use the lumen output of common lamps table to give us candlepower for this activity, since we'll be concerned with light coming straight (perpendicularly) to the surface.

ACTIVITIES AND PROBLEMS:

1. Using the G.E. lumen converter method:

   A. Check the lighting in several rooms in your home and your classroom.

      (1) Find the area in $ft.^2$

      (2) Multiply the area X recommended lumens

      (3) From the lumen output table check the lumens given off by the existing lamps.

   B. How does the present lighting compare to the recommended amount? (How much more or less do your rooms have?)

   C. Do you think the recommended amounts are correct or necessary? Explain.

2. Using the candlepower - footcandle method:

   A. Calculate how many footcandles fall on several surfaces such as your school desk, kitchen table, living room floor, etc.

      (1) Find the candlepower of the lamp (use lumens from lumen output table)

      (2) Measure the distance from lamp to surface in feet

      (3) $$\text{Footcandles} = \frac{\text{candlepower}}{(\text{distance in feet})^2}$$

   B. Compare your values to the following chart. This chart may suggest some additional places to check.

LIGHTING RECOMMENDATIONS IN FOOTCANDLES

Area	Footcandles	Area	Footcandles
baseball seats during game	2	baseball seats before and after game	5
major league infield	125	major league outfield	100
basketball gymnasium	50	football field	50
kitchen	20	fine work area	75
school classroom	30	study halls	15
drafting room	50	laboratories	40

   C. How does the present lighting compare to the recommended amount?

   D. Do you think that the recommended amounts are correct or necessary? Explain.

3. Using a light meter:

   A. Check the actual footcandles received on the same surfaces you calculated footcandles for in part 2 of Activities and Problems and complete the following chart to make comparing them easy.

Calculated - Measured Footcandle Comparison

Place observed	Calculated f.c.	Measured f.c.	Comparison

B. Using reference sources, explain briefly how the light meter operates and some probable ways it could be damaged.

EVALUATION:

1. List at least five factors which determine how much illumination is on an artifically lighted surface.

________________ ________________

________________ ________________

________________ ________________

2. How many 1000 watt flood lamps would be needed to light a major league outfield (see the table for footcandle recommendations) if the lamps are mounted on light poles 100 feet high?

Here are some helps: recommended illumination = ________________ footcandles

Needed candlepower = (footcandles) (distance between field and lamps)^2

= ( ) ( )^2

= ________________ total candlepower

Candlepower per 1000 watt lamp = ________________

Needed lamps = $\frac{\text{total candlepower needed}}{\text{candlepower in one lamp}}$

= (________________)

= (________________) lamp

3. Show all your completed work to your teacher and check through it together.

TEACHER SUPPLEMENT

MODULE: How Bright Are You? Lighting Design

If this module seems too long you may divide it into two parts, using the G.E. Lumen Counter Method as one activity and the Footcandle Method as a second or optional activity.

If you have students who have a definite interest in architecture and specifically lighting we suggest you purchase the "Lighting Handbook" from Westinghouse. This seems to be the definative work in the field and is referred to by lighting engineers and consultants. The information is:

$5.00 Westinghouse Lighting Handbook A-8070
Westinghouse Electric Company, Inc.
3501 South Highway 100
Minneapolis, Minnesota

EVALUATION:

1. Some factors which determine how much illumination is an artifically lighted surface are: candlepower or lumen rating of the lamps; distance between lamp and surface; texturd of surface; color of surface; shading on lamps; direct or indirect lighting; floor coverings; furniture; people; windows.
2. Lighting Problem -

recommended illumination = 100 footcandles

needed candle power = (100 footcandles) $(100 \text{ feet})^2$

= 1,000,000 total candlepower

candlepower per 1000 watt lamp = 24,000 (use same as lumen rating)

needed lamps = $\frac{1{,}000{,}\cancel{000}}{24{,}\cancel{000}}$

= 42 lamps

MODULE: Label and Wrapper Design

CLUSTER: Communications and Media

OCCUPATION: commercial artist
display worker

PREREQUISITES: Lettering ability - produce knowledge

OBJECTIVES:

1. Given a product and a description of its purposes and capabilities you can:
   a. name the approximate age range it is made for.
   b. list three specific things these people need or want that are connected with the product.
   c. choose what you consider to be the most attractive aspect of the product and design a label which emphasizes this.

EQUIPMENT:

drawing and/or painting materials
lettering guide and/or lettering equipment
measuring rule

PROCEDURE:

1. Find out from the maker* or supplier what a specific product is supposed to do, what its ingredients are, whom it is made for, its retail cost, and its size and shape.
2. From this information, design and actually make an attractive label for the product or its container.
3. If possible, show your label to the maker, discuss it and modify it to be the final product label.
4. Repeat the procedure to design an appropriate wrapper or package for the product, again checking and revising your design to please the maker who would be hiring you.

*Note: If some student(s) made products in a class you might use their things as your label and wrapper design subjects.

6. Make some copies of the following questionnaire and ask your classmates to answer the questions.

DATA AND RESULTS:

	LABEL EFFECTS			WRAPPER EFFECTS		
	Yes	No	Some	Yes	No	Some
Attracts you						
Makes you curious						
Unattractive						
Color is right						
Looks expensive						
Aimed at youth						
You know the product						

EVALUATION:

1. Show your label and wrapper to your teacher and have him respond to the questionnaire also.
2. Did your teacher's responses vary from the average of your classmates? Try to explain why it did or did not.
3. Is the product made for a specific age customer?
4. How could labeling and wrapping increase the age range appeal?
5. Is the age of a commercial artist important to his success? Explain.

MODULE: Label and Wrapper Design

TEACHER SUPPLEMENT

ANSWERS TO EVALUATION QUESTIONS:

1. -
2. Some answers may consider age, experience, hobbies, economic level, friends, cultural background, religious persuasion, etc.
3. -
4. If the product is meant for the young market a wrapper might suggest that it is also for the "young in heart" or "flatters every age" or makes a great gift, etc.
5. A commercial artist's age is either a hinderance or help. If he is familiar only with his age group's purchases and the past, he limits his work. If he makes himself aware of the total consumer field and uses his past experience to judge what might be successful and appealing his age is an asset.

SUPPLEMENTARY INFORMATION:

1. Some current art (Op-Art and Pop-Art) has copied labels, usually much larger than normal size, as pictures for walls, etc. You may have some students who wish to do this, perhaps in conjunction with an art class.
2. Trick ink, contest offers, "free" enclosures, etc. might be possible take-offs on this activity.

MODULE: Audio and Video Signal Transmission and Reception

CLUSTER: Communications and Media

OCCUPATION: broadcasting technician

CLUSTER: Construction and Repair

OCCUPATION: radio, T.V. repairman

PRETEST:

OBJECTIVES:

1. Given a kit or necessary parts and directions you can put together a radio sender and/or receiver which works, or some other electronics project (optional).
2. Given a schematic diagram of a radio and/or TV transmitter or receiver you can:
   a. trace current flow through the transmitter part by part in the correct order.
   b. write a sentence or short paragraph naming and describing what each part of the transmitter or receiver does as current flows through it.
3. You can draw and explain a basic radio and TV system showing original input changed to an electrical signal, amplification and transmission, and changing back to the original input in the receiver.

EQUIPMENT:

transceiver kit, radio kit, etc. purchased from a local supply store (optional)

several schematic drawings of transceivers, radio and TV sets, and large transmitters, etc.

PROCEDURE:

1. Buy a transceiver, radio, audio generator, etc. kit at an electronics store and assemble it from the directions.
2. Write a short paper telling what would happen and why if each specific part were missing or working poorly.

3. Trace the current flowing from the power source, battery or wall plug, through the electronic device, numbering each part in order as current flows through it. Name each part and write a sentence describing its function in the device.

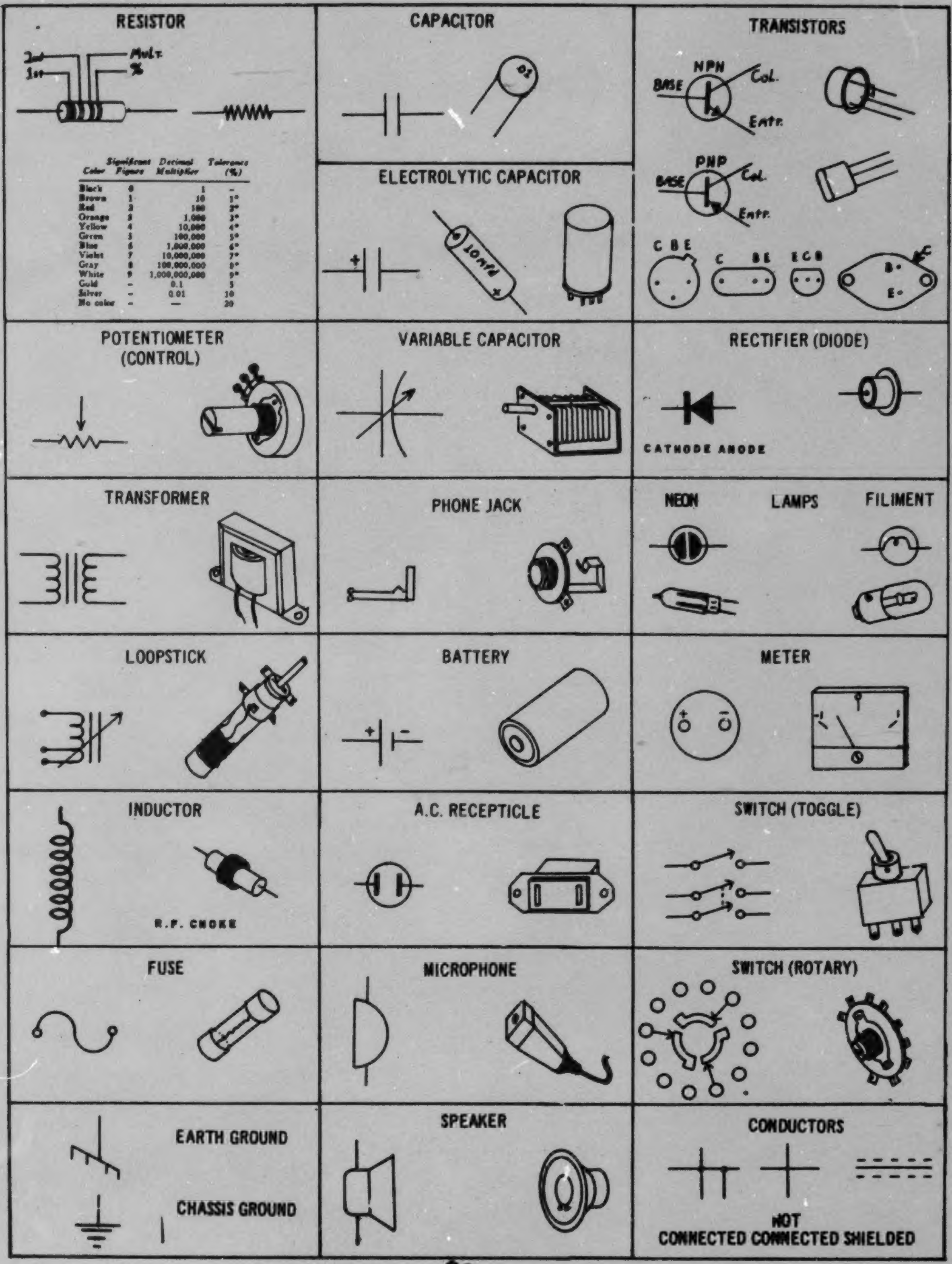
4. Make a chart showing the basic steps and components used to bring singing from the singer through radio to your ears and a picture of a performer through television to your eyes.

   Note: Visit a radio-TV store or shop to get schematic diagrams of a transmitter and receiver.

EVALUATION:

Show your completed kit to your teacher when you have it working. He will judge it on how well it works and your neatness in putting it together. You might write a 10 question quiz on Audio and Video Signal Transmission and Reception. Give the quiz to a classmate or your teacher after you have gone over your drawings and part descriptions with them.

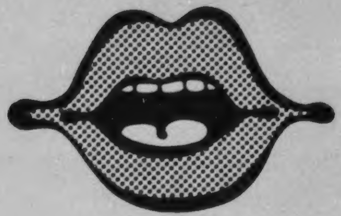
MODULE: Audio and Video Signal Transmission and Reception



Color	Significant Figure	Decimal Multiplier	Tolerance (%)
Black	0	1	–
Brown	1	10	1*
Red	2	100	2*
Orange	3	1,000	3*
Yellow	4	10,000	4*
Green	5	100,000	5*
Blue	6	1,000,000	6*
Violet	7	10,000,000	7*
Gray	8	100,000,000	8*
White	9	1,000,000,000	9*
Gold	–	0.1	5
Silver	–	0.01	10
No color	–	—	20

TEACHER SUPPLEMENT

MODULE: Audio and Video Signal Transmission and Reception



MODULE: Control and Care of Voice

CLUSTER: Communications and Media

OCCUPATION: TV-radio announcer

PREREQUISITES: Ability to set up and use oscilloscope and reel to reel or cassette recorder.

OBJECTIVES:

1. Given rather unusual circumstances such as the scene of an accident, a political convention, an exciting sports event, a coronation, a pain in your body, threat of danger, you can continue talking in an easily understood manner.
2. Given several voice and/or throat conditions you can:
   a. give yourself temporary relief so that you can continue speaking.
   b. know how to treat your illness yourself and when to go to a throat specialist.

EQUIPMENT:

oscilloscope and microphone
tape or cassette recorder
reference material
current newspaper or magazine

PROCEDURE:

1. Voice appearance
   a. set up the oscilloscope or get help in setting it up, and adjust it to give visible waves when you speak into the microphone.
   b. set up the reel to reel or cassette recorder to record your voice.
   c. select an article from some newspaper or magazine and read it into the tape or cassette microphone, trying to maintain a smooth and pleasant voice.
   d. playback the recorder message into the microphone attached to the oscilloscope and observe the wave pattern for regularity.

e. ask other students and/or your teacher to listen to the recording to see if there are any words they can't understand. Practice pronouncing any words that are difficult to understand and record the acricle again.

f. record the message as you try to maintain a regular wave pattern (monotone) on the oscilloscope. Play it back and check for understandability and regularity of wave pattern.

g. draw, as best you can, the two wave patterns (normal and monotone) in the Data Section. You will have to observe carefully to see much difference, but look for differences inheight and closeness of the waves.

h. using a battery operated cassette, record the action occurring at an exciting sporting event, or some other emotional occasion. Repeat the playback procedure with the oscilloscope and listeners.

2. Voice care

Make an appointment with your school nurse to discuss care of your throat and voice. She may recommend a doctor whom you may interview by phone or visit. You should do some reading about your voice before you do this to help you ask questions and understand answers. Get answers for the following questions plus any others you would like to know about.

a. do announcers have to keep their throats warm constantly?

b. does drinking any common beverages harm the throat and larynx?

c. what happens when I get a sore throat?

d. when is complete rest of my voice necessary?

e. what do throat lozenges and gargles do?

f. can I train my voice to be lower or higher without hurting it?

DATA AND RESULTS:

Draw a picture of the wave pattern of your normal voice and of your controlled voice.

normal - -

- - controlled

3. Voice pitch

   a. ask someone with a deep low voice to talk into the microphone as you record the voice. They might also hum or sing a low note.

   b. ask someone with a high voice to talk into the microphone as you record his voice. They could hum or sing also.

   c. play the two voices through the oscilloscope at the same loudness and note what is different about the two sound patterns (waves). Draw each wave.

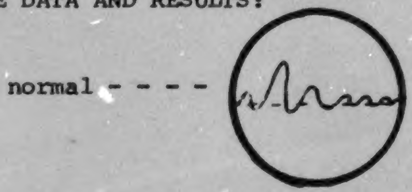
EVALUATION:

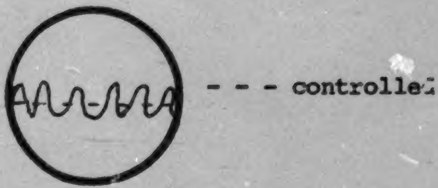
1. Which voice is more pleasing to listen to, the one causing a very regular wave pattern or that causing a changing wave pattern.
2. Describe the difference in understandability and wave regularity between the article recording and the sporting event.
3. What is the wave difference between normal and controlled voice?
4. What is the wave difference between low and high voice?

MODULE: Control and Care of Voice

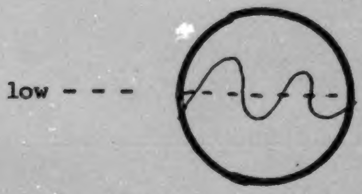
TEACHER SUPPLEMENT

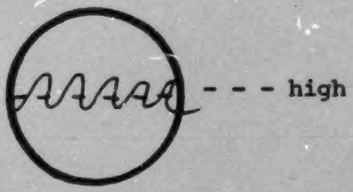
SAMPLE DATA AND RESULTS:





The controlled speech will show more regularity in wave height (volume) and in wave appearance and closeness (pitch). This is rather difficult to sketch. A polaroid picture should be made if the equipment is available.





The low voice will show fewer waves because its frequency is lower, while the high voice will show more waves because of its higher frequency. A one octave increase will about double the frequency when humming or singing a note.

ANSWERS TO QUESTIONS:

1. The changing wave patterns are more pleasing than those of the monotone voice.
2. The excitement of the event may cause an announcer to forget about speaking clearly and cause some of his presentation to be lost. His enthusiasm does carry over to the listener, however, if his speech is generally understandable.

MODULE: Drawing a Cartoon Strip

CLUSTER: Communications and Media

OCCUPATION: cartoonist
commercial artist

PREREQUISITES AND PRETEST:

OBJECTIVE:

1. From your observations and practice you can:
    a. draw, using stick or full figures, people doing given actions.
    b. draw people of infant, young, middle and old age so that someone could guess their approximate age.
    c. draw a car, train, bus, truck and some common animals both moving and non-moving.
2. You can draw a cartoon that will communicate a predetermined theme or emotion to:
    a. a majority of your class mates.
    b. people of another generation.

EQUIPMENT:

drawing and/or painting materials

PROCEDURE:

1. Write a paragraph describing a humorous incident you have experienced or heard about which is suitable for class.
2. Draw a two to ten frame cartoon strip to illustrate the incident, keeping in mind that surprise is one of the most important ingredients in humor.
3. Write a paragraph describing a serious problem which is or may affect your life, such as: pollution, birth control, energy and fuel usage, land usage, brotherhood, integration, or politics.
4. Draw a two to ten frame cartoon strip to illustrate the problem.
5. Reproduce the following questionnaire or write one of your own to find people's understanding of and reactions to your cartoons.

DATA AND RESULTS:

Compile the responses to your questionnaire below to indicate how many viewers got questions a - d correct. You judge if they see what you intended them to see. Calculate the % correct by dividing the number correct by the total number of questionnaires answered and then multiply by 100.

CARTOON STRIP QUESTIONNAIRE

---

1. Humorous Cartoon:

   a. What is the setting?________________________________

   b. What activity is taking place?____________________________

   c. List six objects in the cartoon and what they are doing, if anything:

   1.__________________________ 4.__________________________

   2.__________________________ 5.__________________________

   3.__________________________ 6.__________________________

   d. What is supposed to be humorous in the cartoon?________________

   ____

   e. How could the cartoon be made easier to understand?______________

   ____

   f. How could the cartoon be made more humorous?__________________

   ____

2. Serious Problem Cartoon:

   a. What is the setting?________________________________

   b. What activity is taking place?____________________________

   c. List four objects in the cartoon and what they are doing, if anything:

   1.____

   2.____

   3.____

   4.____

d. What is the problem(s) shown in the cartoon?____________________________

e. What emotion(s) does the cartoon make you feel?__________________________

f. How could the cartoon be made easier to understand?______________________

g. How could the cartoon be made more convincing or startling?_______________

	QUESTIONNAIRE RESULTS				
QUESTION	CORRECT +	WRONG =	TOTAL	PERCENT CORRECT	MOST COMMON WRONG ANSWER
1. a.					
b.					
c.					
d.					
2. a.					
b.					
c.					
d.					

EVALUATION:

1. Show your cartoons and questionnaire results to your teacher.
2. List several personal qualities, characteristics, and skills that a good cartoonist should have.
3. Was there repeated response to question 1. e or 2. f?__________________. If so, what was it and how could you have made your cartoon(s) more understandable?
4. What kinds of objects do you draw well? Why?
5. What kinds of objects do you draw poorly? Why? (Note last column in Questionnaire Results)

MODULE: Drawing A Cartoon Strip

TEACHER SUPPLEMENT

ANSWERS TO QUESTIONS:

1. -

2. A good cartoonist should be a good observed, have a keen memory, be sensitive to people's feelings and emotions, be able to state his own feelings on subjects, be aware of current humor, be knowledgeable about current politics, and feel self confident that he can express himself and communicate to his intended audience.

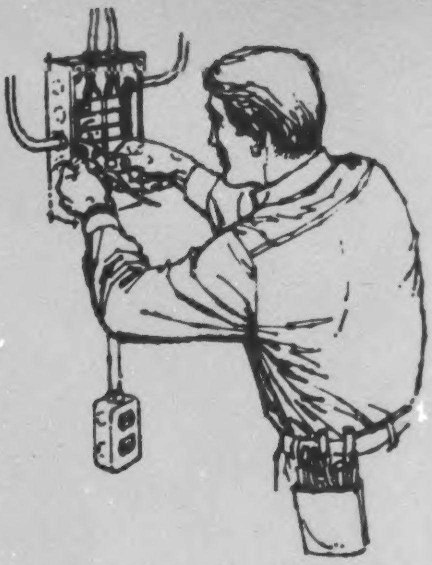
3. -

4. -

5. The information in the last column should be a good indicator of weakness in expression. This information should be heeded even if the cartoonist thinks he is drawing and communicating well in these areas.

ADDITIONAL INFORMATION:

A starting or additional activity might be to have the prospective cartoonist find cartoons from newspapers and magazines which do what he was asked to do in this activity. The questionnaire could be used to evaluate them. Perhaps the questionnaire results, along with an informative and/or questionning letter could be sent to the artist.



MODULE: Making and Using a Fuse and Appliance Wattage Tester

CLUSER: Construction and Repair

OCCUPATION: electrician

CLUSTER: Public Services and Related Professionals

OCCUPATION: science teacher
industrial arts teacher
auto mechanic

PREREQUISITES:

Ability to use the electrical power relationship watts = amps X volts; basic electrical safety; construct a parallel circuit.

1. How many volts are available from the standard home wall outlet?____________
2. How many watts would result from a current of 10 amps pushed along by 110 volts?______________________
3. How many amps would an iron use if it was rated at 1500 watts when plugged into a home wall outlet?______________________________
4. How many volts does an electric clothes dryer need to operate at 1100 watts using 5 amps of current?_______________________

OBJECTIVES:

1. Given a household fuse you can:
    a. tell its amperage rating
    b. tell what you would expect to happen to the wiring and appliance if you used a fuse of 1/2 or of twice the amp rating in its place.
    c. tell at what approximate amp current it would melt or "blow."
    d. list several electrical objects or appliances it would protect.
    e. calculate, assuming standard household voltage, the wattage of the appliance it would protect without melting.
    f. tell whether the fuse is good or has melted

EQUIPMENT:

five light sockets with bases

one wall plug

one small cadtridge fuse holder

4' - 5' insulated bell wire

switches (optional)

VOM meter (optional)

assortment of small cartridge and plug type fuses

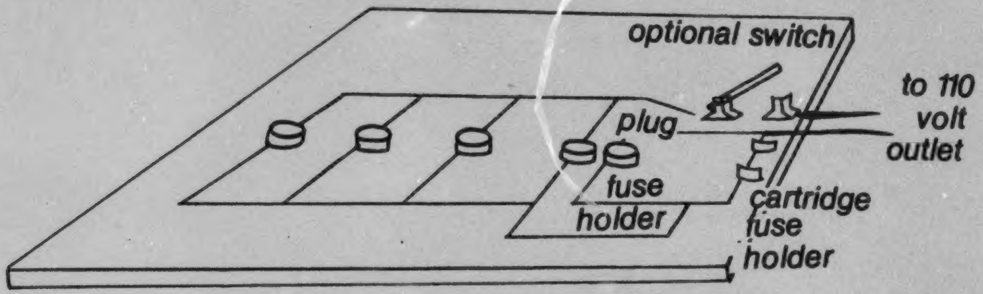
assortment of light bulbs and appliances with various wattage ratings

wooden board approximately 12" x 6" x 1"

four plug in adapters for light sockets

PROCEDURE:

1. Carefully and neatly assemble the testing board according to the diagram. Have your teacher check the completed circuit. (There may be a tester ready to use so check with your teacher)



2. Put a one amp cartridge fuse in the holder, plug in the tester, and screw light bulbs, of 60 to 100 watts, into the sockets until the fuse melts. You can tell the fuse has melted because the lights go out. Remove the fuse and examine it so you will know what a "blown" fuse looks like. Record your information in the Data Table and calculate the amperage that made the fuse melt.

Example:

$$\text{amps} = \frac{\text{watts}}{\text{volts}} = \frac{\text{220 watts (total bulb wattage)}}{\text{110 volts (line voltage)}}$$

In the last Data Table column show how much over the listed amp rating the fuse could take. For example if the one amp fuse melted at 2.3 amps you should put down + 1.3, showing that the fuse melted at 1.3 amps more than the listed rating.

3. Repeat the previous procedure using a two or three amp cartridge duse and light bulbs of larger wattage. Record your observations and calculations in the Data Table.

4. Place the smallest plug type fuse you have in the fuse socket.

   Note 4a. 6 1/4 amp plug type fuses are available at hardware stores but not in common use in homes.

   Screw the plug in adapters into the light sockets. Plug in the fuse tester and proceed to plug appliances of known wattages into the plugs until the fuse melts. Some approximate appliance wattage examples are: iron-625 to 1100; hot plate 500 to 1500; electric range 750 to 1500 per element; toaster 750 - 1200.

   Note 4b. You could check the fuse using an electric range by turning on one element at a time to increase the wattage and amperage. Most electric ranges operate on 220 volt circuits.

5. Repeat the previous procedure using several larger plug type fuses and more appliances or higher wattages. Record your observations and calculations in the Data Table.

DATA AND RESULTS:

DATA TABLE: FUSE TESTING OBSERVATIONS AND CALCULATIONS

Appliances Used	Individual Wattage(s)	Total Wattage ⨸	Assumed Line Voltage ⊜	Calculated Amperage ⊖	Fuse Amperage Rating ⊜	Difference between actual and rated amperage (+ or -)

OPTIONAL ACTIVITY:

A. With your teacher's or the electricity teacher's help check the line voltage at the wall outlet with a voltmeter and record this in the optional Data Table.

B. Plug some appliance like an iron, heater, toaster, etc. into the outlet and check the amperage flowing through it with the meter and record this in the Optional Data Table.

Note: BE VERY CAREFUL YOU DON'T OVERLOAD THE METER BY USING TOO SMALL A SCALE SETTING.

MODULE: Broadcast Item Preparation and Presentation

TEACHER SUPPLEMENT

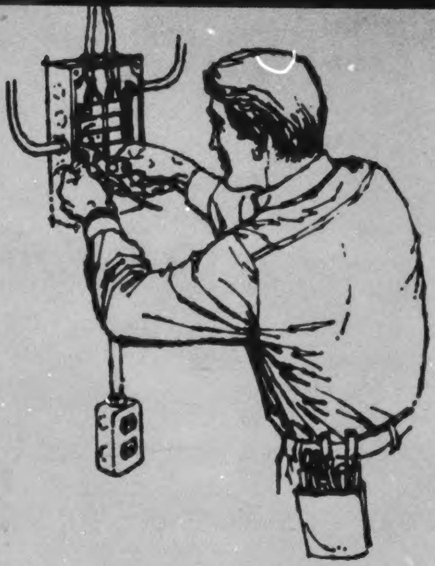
SAMPLE DATA:

Statement identification:

a. I   b. F   c. I   d. I   e. I   f. F

ANSWERS TO EVALUATION QUESTIONS:

1. Students may check their reading speed in words per minute and then write a corresponding number of words. They might do a similar measurement using lines instead of words.
2. Present tense verbs, numbers from stated measurements, observations from stated experiences, etc. indicate factual statements.
3. Phrases like "I expect", "therefore" or "seems to be" along with future tense verbs, etc. indicate interpretations or editorial statements.



MODULE: Making and Using a Fuse and Appliance Wattage Tester

CLUSER: Construction and Repair

OCCUPATION: electrician

CLUSTER: Public Services and Related Professionals

OCCUPATION: science teacher
industrial arts teacher
auto mechanic

PREREQUISITES:

Ability to use the electrical power relationship watts = amps X volts; basic electrical safety; construct a parallel circuit.

1. How many volts are available from the standard home wall outlet?____________
2. How many watts would result from a current of 10 amps pushed along by 110 volts?______________________
3. How many amps would an iron use if it was rated at 1500 watts when plugged into a home wall outlet?______________________________
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OBJECTIVES:

1. Given a household fuse you can:
    a. tell its amperage rating
    b. tell what you would expect to happen to the wiring and appliance if you used a fuse of 1/2 or of twice the amp rating in its place.
    c. tell at what approximate amp current it would melt or "blow."
    d. list several electrical objects or appliances it would protect.
    e. calculate, assuming standard household voltage, the wattage of the appliance it would protect without melting.
    f. tell whether the fuse is good or has melted

EQUIPMENT:

five light sockets with bases

one wall plug

one small cadtridge fuse holder

4' - 5' insulated bell wire

switches (optional)

VOM meter (optional)

assortment of small cartridge and plug type fuses

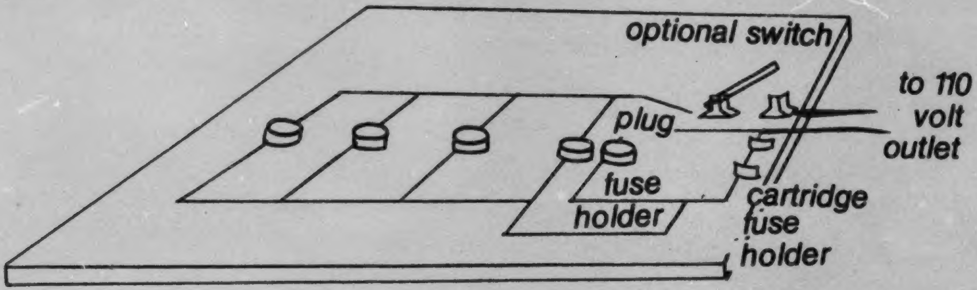
assortment of light bulbs and appliances with various wattage ratings

wooden board approximately 12" x 6" x 1"

four plug in adapters for light sockets

PROCEDURE:

1. Carefully and neatly assemble the testing board according to the diagram. Have your teacher check the completed circuit. (There may be a tester ready to use so check with your teacher)



2. Put a one amp cartridge fuse in the holder, plug in the tester, and screw light bulbs, of 60 to 100 watts, into the sockets until the fuse melts. You can tell the fuse has melted because the lights go out. Remove the fuse and examine it so you will know what a "blown" fuse looks like. Record your information in the Data Table and calculate the amperage that made the fuse melt.

Example: $\text{amps} = \frac{\text{watts}}{\text{volts}} = \frac{\text{220 watts (total bulb wattage)}}{\text{110 volts (line voltage)}}$

In the last Data Table column show how much over the listed amp rating the fuse could take. For example if the one amp fuse melted at 2.3 amps you should put down + 1.3, showing that the fuse melted at 1.3 amps more than the listed rating.

3. Repeat the previous procedure using a two or three amp cartridge duse and light bulbs of larger wattage. Record your observations and calculations in the Data Table.

4. Place the smallest plug type fuse you have in the fuse socket.

   Note 4a. 6 1/4 amp plug type fuses are available at hardware stores but not in common use in homes.

   Screw the plug in adapters into the light sockets. Plug in the fuse tester and proceed to plug appliances of known wattages into the plugs until the fuse melts. Some approximate appliance wattage examples are: iron-625 to 1100; hot plate 500 to 1500; electric range 750 to 1500 per element; toaster 750 - 1200.

   Note 4b. You could check the fuse using an electric range by turning on one element at a time to increase the wattage and amperage. Most electric ranges operate on 220 volt circuits.

5. Repeat the previous procedure using several larger plug type fuses and more appliances or higher wattages. Record your observations and calculations in the Data Table.

DATA AND RESULTS:

DATA TABLE: FUSE TESTING OBSERVATIONS AND CALCULATIONS

Appliances Used	Individual Wattage(s)	Total Wattage	⨸ Assumed Line Voltage	⊜ Calculated Amperage	⊖ Fuse Amperage Rating	⊜ Difference betwe actual and rated amperage (+ or -

OPTIONAL ACTIVITY:

A. With your teacher's or the electricity teacher's help check the line voltage at the wall outlet with a voltmeter and record this in the optional Data Table.

B. Plug some appliance like an iron, heater, toaster, etc. into the outlet and check the amperage flowing through it with the meter and record this in the Optional Data Table.

Note: BE VERY CAREFUL YOU DON'T OVERLOAD THE METER BY USING TOO SMALL A SCALE SETTING.

C. Calculate the actual wattage used by the appliance in the Optional Data Table.

D. Compare your calculated wattage to the wattage listed on the appliance and record in the optional Data Table:

Optional Data Table: VOM Meter Observations and Calculations

Appliance Used	Actual Line Voltage ⊗	Actual Appliance Amperage ⊜	Calculated Wattage	Listed Wattage	Wattage Comparison

EVALUATION:

1. If you went to the hardware store to buy 15 amp fuses for your home and the clerk said, "Take a 30 amp fuse instead, they're twice as good and cost the same," what would be your polite reply and your reasoning?

2. Why are fuses included in most electrical circuits?

3. In using the fuse tester you found that fuses usually melt at somewhat

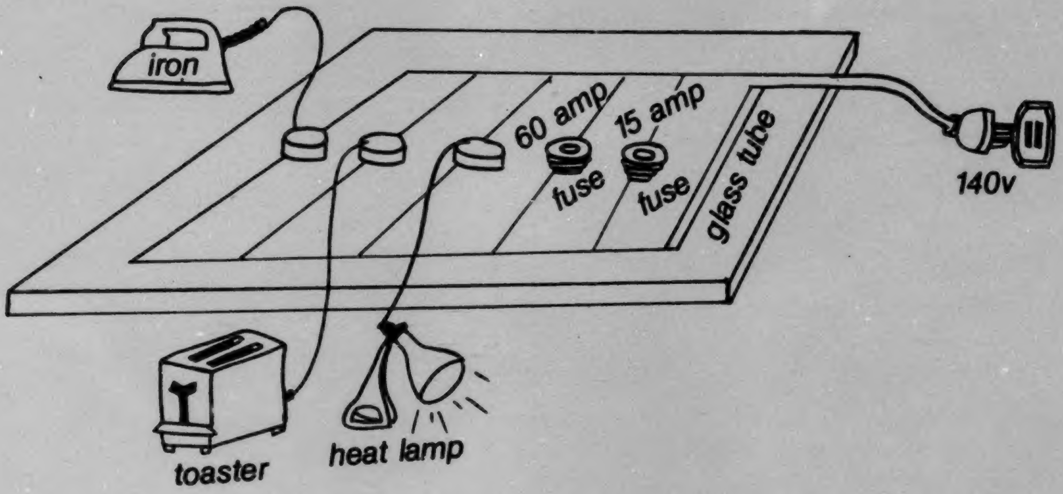
__________________ amperages than that listed on the fuse.
higher - lower

   a. Was this difference consistent in the fuses you tested?

   b. (Optional) Express this difference as a percent of the listed amperage.
   Example: 100% higher or 50% lower

4. What is the proportional relationship (directly or inversely) between the wattage and amperage? (i.e. does the wattage rise as the amps rise?)

5. List as many things wrong with the circuit diagrammed as you can.



MODULE: Making and Using a Fuse and Appliance Wattage Tester

TEACHER SUPPLEMENT

SAMPLE DATA:

Appliances Used	Individual Wattage(s)	Total Wattage	Assumed Line Voltage	Calculated Amperage	Fuse Amperage Rating	Difference
toaster hot plate amplifier	900 W 1000 W 80 W	1980 Watts	110 volts	18 amps	15 amps	+3 amps

Appliance Used	Actual Line Voltage	Actual Appliance Amperage	Calculated Wattage	Listed Wattage	Wattage Comparison
iron	118	7.6	896.8 or 900	800	100 over list

ANSWERS TO QUESTIONS:

1. The 30 amp fuses would not supply the needed protection as they would melt at a higher temperature than was allowed in the circuit.
2. Fuse protect against over heating of heat damageable materials in close proximity to current carrying wires.
3. Fuses probably melt anywhere from 10 to 100% higher than the listed ratings, with the smallest fuses having the greatest percent.
4. There is a directly proportional relationship between amps and watts, i.e., with an increase in amp flow there is a similar increase in watt power used.
5. Fuse in parallel; switch open but appliances working; 140 volts instead of 110 at wall outlet; too many appliances for 15 amp fuse; glass "wire" is a non-conductor; etc.

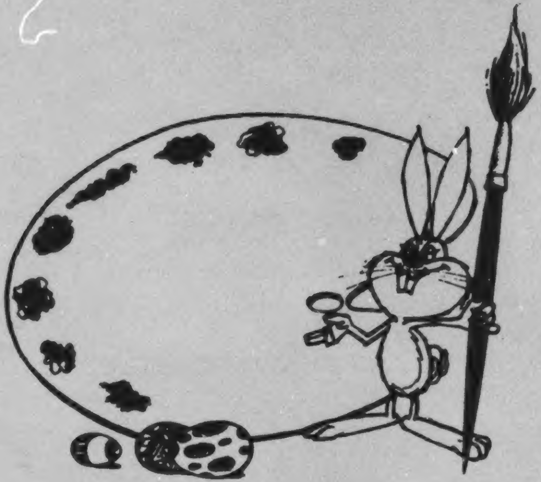
MODULE: Mixing and Matching Paint

CLUSTER: Construction and Repair

OCCUPATION: auto body repair
painter
plasterer

CLUSTER: Consumer, Foods and Homemaking

OCCUPATION: interior designer



PREREQUISITES AND PRETEST:

1. Be able to state groups of numbers in their lowest terms (prime numbers in a ratio).

Example: 30 : 18 : 3 : = 10 : 6 : 1

a. 40 : 24 : 8 = __________:_____________:__________.

b. 57 : 21 : 13 = __________:_____________:__________.

c. 12 : 15 : 6 : 36 = __________:_____________:__________.

2. Remember that in mixing primary colors:

   a. red and yellow make orange.
   b. red and blue make violet.
   c. yellow and blue make green.
   d. yellow, red, and blue make brown.

OBJECTIVES:

1. Given a color sample, you can make a paint mixture using any or all of the pigments, red, yellow, blue, black, and white, which will match the original sample.
2. You can devise specifications or a "recipe" for this color sample which will make it easily reproducable from the basic pigments, by calculating the ratios of the amounts of paint drops of original color needed.

MATERIALS:

color sample you are to match (paint chips from paint store)

paper

petri dish (plastic disposable)

5 eye droppers

paint samples (tempera, latex, or oil base, but all of one kind media) black, white, yellow, blue, red

water color paint brush

PROCEDURE:

1. Obtain a color sample from your instructor.
2. By adding one drop at a time (and keeping track of the number of drops of each color added), mix a combination of paints using only the colors supplied, which will match the color sample you've been given. Try to use the least number of drops possible.
3. State the ratio of basic color amounts to each other for each of the three samples.

DATA AND RESULTS:

	Color sample number or name					
	Number of drops	Ratio of prime numbers	Number of drops	Ratio of prime numbers	Number of drops	Ratio of prime numbers
BLACK						
WHITE						
RED						
YELLOW						
BLUE						

EVALUATION:

Check with your instructor and another classmate to see if they agree with your color match. If they do not, repeat the color mixing and check again.

TEACHER SUPPLEMENT

ANSWER SHEET

MODULE: Mixing and Matching Paint

PRETEST:

a. 5 : 3 : 1

b. 57 : 21 : 13

c. 4 : 15 : 2 : 12

MODULE: Testing the Holding Power of Nails

CLUSTER: Construction and Repair

OCCUPATION: carpenter
roofer

PREREQUISITES:

Be able to measure with a vernier caliper.

OBJECTIVE:

1. Given the necessary lab and construction materials, you can determine the relationship between the holding power of a nail and its thickness.
2. Given the materials you need, you can design and carry out an experiment which will answer the question, "Does the kind of wood affect the holding power of a nail of a given thickness?"
3. After doing the experiments, you can suggest any difficulty which might be encountered with using nails which are (a) relatively thick (b) relatively thin.

EQUIPMENT:

- nails of three different thicknesses
- wood from three different kinds of trees
- hooked weights of various mass
- means of support of the wood on both ends
- hammer
- string
- vernier caliper

PROCEDURE:

1. Hammer one headed nail of each of the three thicknesses exactly 1/4 inch into the same side of a board. (If your particular nails are held firmly by the wood, you may drive all nails in 1/8 inch instead)
2. Turn the board upside down and support it so that the nail heads face the floor.
3. Tie a string around the nail and gradually add the hooked weights on a loop of the string until the weights pull the nail out of the board. Use string lengths that keep the weights from falling more than an inch or two.

4. Repeat the procedure for each of the three nails and record the results below.

DATA AND RESULTS:

1.

Thickness of Nail	Total Weight Needed To Pull Out Nail

2. What is the relationship between the thickness of the nail and its holding power?

EVALUATION:

1. Design and carry out an experiment which will answer the question, "Does the kind of wood affect the holding power of a nail of a given thickness?" Report your procedure, data, and results below.

2. Suggest any difficulty which might be encountered in using nails with thicknesses which are relatively:

a. thin____

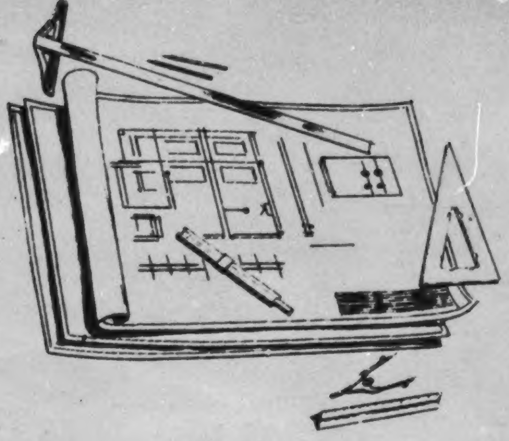
b. thick____

MODULE: Testing the Holding Power of Nails

TEACHER SUPPLEMENT

EVALUATION QUESTIONS:

1. The thickness of the nails and all other conditions for experiment should be the same. The only exception should be the use of a different kind of wood for each trial.
2. a. Thin nails are more likely to bend before they are entirely driven in.
   b. Thick nails have more of a tendency to split the wood and require more force to be driven in.



MODULE: Preparation of Blueprints

CLUSTER: Construction and Repair

OCCUPATION: architect

draftsman

PREREQUISITES AND PRETEST:

OBJECTIVES:

1. Given the necessary materials, you can:
    a. make some blueprint paper.
    b. make a blueprint from a floor plan.
2. After making your own blueprint paper and blueprint, you can:
    a. suggest reasons why your blueprint may be difficult to read.
    b. suggest how you would alter your method to improve the quality.

EQUIPMENT:

- darkened room
- rectangular shallow pan or tray
- 3 sheets of absorbent paper
- 10 gm. ferric ammonium citrate
- 10 gm. pottasium ferricyanide
- glass or Lucite plate to fit over paper
- 100 ml. distilled water
- a floor plan (done in heavy black lines in lightweight paper)
- sunlight
- 2 beakers

PROCEDURE:

Architects and draftsmen usually don't make their own blueprint paper. Since you need this paper for this activity, you might enjoy making your own.

In a darkened room (absolute darkness unnecessary):

1. Dissolve 10 gm. of ferric ammonium citrate in 50 ml. of water. Pour into shallow pan or tray.
2. Dip each of the three single sheets of stiff paper in the solution and dry them in the darkened room or cupboard. Dispose of this solution and thoroughly rinse the pan or tray.

3. Place the blueprint paper under the floor plan and expose the plan to the sunlight for about 15 minutes. The sheets should be tightly taped to the window or placed under plate glass or plastic to insure a tight contact between the floor plan and blueprint paper.
4. Dissolve 10 gm. of pottasium ferricyanide in 50 mls. of water and place in a shallow pan or tray. Run the exposed blueprint paper through this solution.
5. Wash the blueprint paper under running water and allow to dry.

DATA, RESULTS AND EVALUATION:

1. Turn your blueprint into your instructor.
2. If your blueprint is not easy to read, list the problems and what you think is the source of the problem.
3. If the blueprint is too dark, how could you have avoided this?
4. If the blueprint is too light, how could you have avoided this?
5. If the images are hazy, what might have been the cause?
6. What conditions are best for blueprint storage.

ADDITIONAL ACTIVITY: You can compare the copy quality of commercial blueprint paper with the paper you make yourself.

RESOURCE: Joseph Brandwein, Morhold, Pollack, Castka,
A Source Book for the Physical Sciences,
Harcourt, Brace and World, 1961, p. 32.

Brinkerhoff, Cross, Watson, Brandwein,
The Physical World,
Harcourt, Brace and World, 1963, p. 444.

TEACHER SUPPLEMENT

2. Exposed for too long, not exposed long enough, washed too much, not washed enough, using incorrectly made solutions, preparation in an area with too much light, using drawings in which the lines are not distinct, etc.
3. Blueprints which are too dark can be avoided by shortening the light exposure time.
4. Blueprints which are too light may not have been exposed long enough or the original line drawings may not be bold enough.
5. Hazy images may result from using print paper which has already been slightly exposed or from making prints from drawings in which the lines are not bold or distinct enough.
6. Blueprints are best stored in a dark, dry, cool place.

MODULE: Shaping Up A Battered Metal Can

CLUSTER: Construction and Repair

OCCUPATION: auto body repair

PREREQUISITES AND PRETEST:

OBJECTIVES:

1. Given a metal can which has been dented and punctured, you can restore an area designated by your teacher to approximately its original appearance.

EQUIPMENT:

2 - 3 lb. empty coffee can which has been punctured, dented, and knocked out of shape (but not flattened)

auto body patching kit (fiber glass, etc.)

spray enamel or lacquer

assorted tools

PROCEDURE:

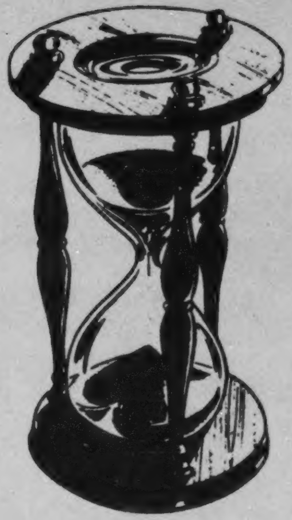
1. Using the tools you have available, return the can to its original shape.
2. Fill in any remaining holes and dents with the patching kit material according to the directions on the label.
3. Paint the entier exterior surface. Be sure to follow the label directions for the paint. You need not be concerned about the interior of the can.

RESULTS AND EVALUATION:

1. Turn your finished product in to your instructor.
2. What part of this operation was the most difficult and why?
3. If you were to repeat this activity how could you improve your performance.

TEACHER SUPPLEMENT

MODULE: Shaping Up A Battered Metal Can



MODULE: Controlling the Drying Time for Plaster

CLUSTER: Construction and Repair

OCCUPATION: plasterer

CLUSTER: Fine Arts and Humanities

OCCUPATION: artist

PRETEST AND PREREQUISITES:

Be able to calculate percent.

a. What is 15% of 80?______________

b. What is 1% of 65?______________

OBJECTIVES:

1. Given the total weight, you can calculate the weight needed of each ingredient which makes up a given percent of the total.
2. Given the necessary lab materials, you can make plaster casts, each of which will harden at a different rate, depending upon the proportions of the ingredients added.
3. You can suggest the circumstances under which you would want plaster to:
    a. dry as quickly as possible.
    b. dry at a delayed rate.
4. You can design an experiment to test the effect of temperature on the drying rate of plaster.
5. You can suggest other factors which might affect the drying rate of plaster of Paris.

EQUIPMENT:

calcium oxide
plaster of Paris
water
3 paper drinking cups
balance
3 small paper plates
spoon or spatula
clock
stirring rod

PROCEDURE:

1. The dry ingredients in each mixture should have a total weight of 20 gms. Calculate the relative amounts of plaster of Paris and calcium oxide needed and make up a mixture of the desired percentage. (Remember the percent totals of plaster of Paris and calcium oxide should total 100%)

% plaster of Paris	gm. plaster of Paris	gms. of calcium oxide
90		
95		
100		

2. Prepare the plaster of Paris mixtures described in Step 1 by adding 15 mls. of water very slowly to the dry ingredients while stirring vigorously in a paper cup. Record the starting time at the point at which you begin to add water. Be sure the mixture is of an even consistency and not lumpy. Depending on humidity conditions, it may be necessary to increase or decrease the amount of water added in order to get a consistency which is not too lumpy or too watery. If the amount of water is changed, be sure that it is changed for all three mixtures.
3. Continue to add water until the mixture is uniformly paste-like but not runny. (If the solution becomes too watery, you can mix in more dry ingredients.)
4. Pour and scrape the plaster from a paper cup into a paper plate.
5. Allow the sample to dry until its surface has changed from glossy to completely dull, and again record the exact time.
   5a. An alternative test for dryness may be the point at which the sample no longer shows finger marks when you merely touch it.

DATA AND RESULTS:

% Plaster of Paris	Starting Time	Finish Time	Total Drying Time
90			
95			
100			

EVALUATION:

1. What is the relationship between the % of calcium oxide in a sample and the drying time?

2. Suggest circumstances under which you would want plaster to dry as quickly as possible.

3. Suggest circumstances under which you would want to delay the rate at which plaster dries.

4. Design an experiment to test the effect of temperature on the drying time of plaster of Paris.

5. Suggest other factors which may affect the drying rate of plaster.

RESOURCE: Joseph, Brandwein, Morholt, Pollack, Castka,
A Source Book for the Physical Sciences,
Harcourt, Brace, and World, 1961, p. 317.

MODULE: Controlling the Drying Time for Plaster

TEACHER SUPPLEMENT

PRETEST:

a. 1.2

b. 6.5

EVALUATION:

I. The more calcium oxide there is in the sample, the longer it takes the plaster to dry.

2. a. In a cast on a broken bone.

   b. When it's used on a ceiling.

3. a. When you want to give it texture or special form.

   b. When you work with a large quantity of it.

4. After mixing, divide plaster into three samples. Dry one in the refrigerator at about 40° F, one at room temperature at about 72° F, and one in the oven at 200° F. Check all samples at regular time intervals and compare their drying rates.

5. Humidity, the liquid used, the amount of water used.

MODULE: A Comparison of Heat Insulating Materials

CLUSTER: Construction and Repair

OCCUPATION: carpenter

PREREQUISITES AND PRETEST:

1. Be able to use a balance.
2. Be able to calculate the % weight loss of an object (to nearest 0.1%)
   a. If you weigh 130 lbs. one month and 125 lbs. a month later, the % loss in weight was______________
   b. Before weight = 11 gm., after weight = 9 gm., % weight loss = ___________.

OBJECTIVES:

1. Given the necessary materials, you can carry out an experiment which will help you determine the heat insulating qualities of various materials.
2. After experimenting with insulating materials you can describe two properties which make construction materials (a) good heat insulators, (b) poor heat insulators.

EQUIPMENT:

A variety of materials around the lab which your instructor will allow you to use.

four ice cubes
balance

PROCEDURE:

1. Weigh an ice cube to the nearest 0.1 gram. Devise a way to insulate the cube which will prevent or slow its melting. Label and set aside for 30 minutes. Do not use a refrigerator, open a window or leave the classroom. Take care that any melted ice does not cause any water damage. At the end of the 30 minutes, reweigh the ice cube and calculate the percentage loss in weight.
2. Repeat this basic procedure for 3 other ice cubes, using a different method and materials for insulation each time but for 30 minutes each. Record all before and after weights and percentages in the table.

DATA AND RESULTS:

CUBE	METHOD OF INSULATION	BEFORE WEIGHT	AFTER WEIGHT	% WEIGHT LOSS
#1				
#2				
#3				
#4				

1. Which method provided the best insulation?

2. Which method provided the least insulation?

EVALUATION:

1. Describe two properties of materials which are good insulators.

2. Describe two properties of materials which are poor insulators.

MODULE: A Comparison of Heat Insulating Materials

TEACHER SUPPLEMENT

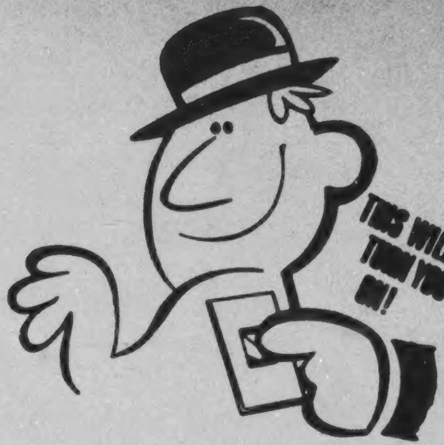
PRETEST:

a. 3.8%

b. 18.2%

EVALUATION:

1. a. Usually non-metals
    b. Have air spaces in them.
    c. Usually light weight
    d. May have reflective surfaces
    e. Seal tightly
    f. etc.
2. a. cold to the touch
    b. metal
    c. heavy
    d. open to the air
    e. etc.


THIS WILL TURN YOU ON!

MODULE: Making and Using a Magnetizer

CLUSTER: Construction and Repair

OCCUPATION: electrician

CLUSTER: Public Services and Related Professions

OCCUPATION: science and industrial arts teacher

PREREQUISITES AND PRETEST:

Knowledge of basic electrical safety; ability to hook up a series circuit, knowledge of the left hand rule of electron flow.

1. State the left hand rule:____
2. Draw a series circuit which includes a power source, switch, two lamps, and bell.

OBJECTIVES:

1. Given a power supply you can:
    a. identify the direct current output
    b. identify the direction of electron flow from the power source
    c. hook up the magnetizer so that you know, using the left hand rule, where the north and south poles are
2. You can correctly place a fuse in a circuit and explain its purpose and operation.

Optional Objective:

You can describe briefly how the magnetizer works and how a piece of iron becomes magnetized.

EQUIPMENT:

Note: Six volt batteries will work but probably won't melt the fuse.

D.C. power supply

battery charger, or A.C. rectifier (a rectifier changes A.C. to D.C.)

Note: 110 volt A.C. current from a wall socket may also be used with caution but you won't be able to pre-know where the north and south poles will be. They may easily be found by using a magnet which has the poles correctly marked and bringing this near your new magnet.

two thin round head screws or nails 2" long

about 20' of insulated bell wire

plastic or cardboard tube about 4" long and 1" to 1 1/2" in diameter

4 press clip connectors

mounting board approximately 8" x 4" x 1"

switch (optional)

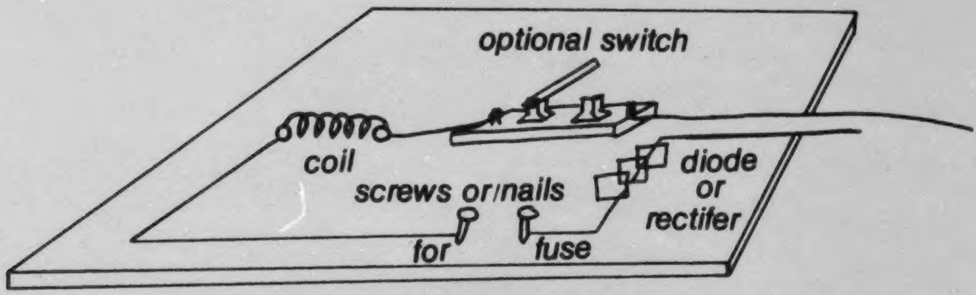
baby food jar or equivalent

small amount of aluminum foil

10 pins or paper clips

PROCEDURE:

1. Wind about 100 turns of wire around the tube.
2. Complete the magnetizer set up from the diagram. Have your teacher check the circuit before you continue.



3. Find the north pole of the magnetizer coil by noting the direction electrons will flow around the circuit (electrons flow from negative to positive). The end of the coil electrons leave is the north pole (part of left hand rule). Mark the board indicating the negative connecting clip and the resulting north end of the magnetizar coil.
4. Cut a small strip of aluminum foil just long enought ot go between the two screws or nails and about 1/4" wide. This acts as a fuse and melts to break the circuit when it gets hot. Pinch the ends of the foil fuse to the screws and cover them with the baby food jar to protect yourself from sparks.
5. Connect the magnetizer circuit to the highest voltage D.C. terminals on your power source.
6. Check the strength of the magnet before placing in the coil by counting and recording in the Data Table, the number of pins or paper clips the magnet will pick up. Place an iron rod, large nail, or weak bar magnet inside the coil. The south end of the bar magnet should be pointed north inside the coil, because the south end of the magnet is actually the "south seeking" end.
7. Turn on the electricity. The fuse should melt soon and shut off the current through the circuit. If the fuse doesn't melt turn the electricity off as soon as the coil get fairly warm or in about 30 seconds. Turn off the power supply or pull the wall plug. Take out the iron bar and check for magnetic field strength, by counting, and recording in the Data Table, how many pins or clips it picked up. You may increase the magnetic strength by making a new fuse and repeating the magnetizing procedure several times. Make sure that you place the bar in the coil facing the same direction each time.

Optional Information on Magnetism:

The D.C. power supply or the rectifier must be placed in series circuit in order for magnetizing to occur. In an A.C. circuit the electrons move back and forth about 120 times per second. To magnetize an iron rod we want to surround it with a strong magnetic field going in just one direction parallel to the rod. Direct current from the power supply or produced from A.C. by the rectifier does this because the electrons are flowing in just one direction, from negative to positive. The strong magnetic field in the coil produced by this one directional electron flow, pushes the atoms in the iron until most of them are facing the same direction. Then the tiny magnetic force each of their spinning electrons produce is added up to make the large total magnetic force which remains in the rod for a long time. The rod loses its magnetism as the atoms it is made of become disarranged in several different ways.

DATA AND RESULTS:

Pins or clips picked up: before____________________after_______________

Write a few sentences or a paragraph telling:

a. any problems in putting the magnetizer together

b. how you solved these problems

c. how well it worked

d. how much it cost - or would cost - if you had to buy all the materials

EVALUATION:

1. How could you make the magnetizer stronger?
2. How could the magnetizer be a de-magnetizer?
3. What are some things that could happen to a permanent magnet to cause it to lose magnetic strength?
4. How many times stronger did the magnetizer make the magnets?
5. Why does the fuse melt (if yours did)?
6. How does a fuse protect against electrical fires?

MODULE: Making and Using a Magnetizer

TEACHER SUPPLEMENT

SAMPLE DATA:

The magnet should be able to pick up more pins or paper clips after being in the coil. There is the possibility that the magnet was placed in the coil backward. This would weaken the magnet, or completely reverse the poles and make it strong, depending on the time in the coil.

ANSWERS TO QUESTIONS:

1. Adding more turns to the coil and/or using more voltage and current would strengthen the magnetizer.
2. Alternating current which gradually lessened or pulling a magnet in the coil backward for a short time would cause some demagnetizing.
3. If permanent magnets are dropped, heated, stored with like poles together, or placed in non-parallel magnetic fields, they lose some or all of their original magnetism.
4. It may double or triple the strength depending on original strength.
5. Flowing electrons generate heat through friction which melts the low melting point aluminum foil.
6. The fuse melts before the wires get hot enough to start the wood, paper, or plaster burning and stops the flow of electricity.

SUPPLEMENTARY INFORMATION:

The magnetizer will work if connected to A.C. without the rectifier in the circuit. You have no control over the polarity of the magnet however. It does make a simpler circuit and the fuse melts spectacularly every time.

MODULE: Kinds of Paints and Different Surfaces

CLUSTER: Construction and Repair

OCCUPATION: auto body repairman

painter

CLUSTER: Consumer, Foods and Homemaking

OCCUPATION: interior designer

PREREQUISITES AND PRETEST:

OBJECTIVES:

1. Given several different paints and several different surfaces, you can determine the following:
   a. the effects of different paints on the same kind of surface.
   b. the effects of a certain paint on different surfaces.
   c. which type of paint is best suited for each specific type of surface.

EQUIPMENT:

3 unpainted surfaces of tin can*
3 primed surfaces of tin can*
3 unpainted wood surfaces (at least 3" x 3")*
3 primed wood surfaces (at least 3" x 3")*
mineral spirits or turpentine (paint solvents)
liquid detergent
nail
water

spray enamel
spray lacquer
metal primer
wood primer
latex paint
3 paint brushes
steel wool

*all cans and wood must be exactly the same kind of material

PROCEDURE:

1. Coat three unpainted metal surfaces with metal primer according to the directions on the can.
2. Coat three unpainted wood surfaces with wood primer according to directions on the can.

3. Paint one of each of the surfaces listed in the column at the left below, with each of the paint listed in the column at the right below.

bare metal	spray enamel
primed metal	spray lacquer
unpainted wood	latex
primed wood	

4. In table one, record information regarding drying time (dry to touch).

5. Make a judgement on the appearance by checking the appropriate column and briefly explaining your choice.

6. One day later, try to scratch the surface with a nail, scour it with steel wool, and place drops of liquid detergent on each one. Record the results below in table 2.

DATA AND RESULTS:

TABLE I:

	Drying Time	Appearance (check one)			
		Satisfactory	Touch-up	Repaint	Why?
Previously non-painted metal					
Spray enamel					
Spray lacquer					
Latex					
Primed metal					
Spray enamel					
Spray lacquer					
Latex					
Previously non-painted wood					
Spray enamel					
Spray lacquer					
Latex					
Primed wood					
Spray enamel					
Spray lacquer					
Latex					

TABLE II:

	Scratch Test	Scour Test	Detergent Test
Previously non-painted metal			
Spray enamel			
Spray lacquer			
Latex			
Primed metal			
Spray enamel			
Spray lacquer			
Latex			
Previously non-painted wood			
Spray enamel			
Spray lacquer			
Latex			
Primed wood			
Spray enamel			
Spray lacquer			
Latex			

EVALUATION:

1. Does it make any difference whether or not a surface to be painted has been primed?
2. Which kind of paint seems to be best for metal surfaces?
3. Which kind of paint seems best for wooden surfaces?
4. Which combination of surface and paint had the fastest drying time?
5. Which combination of surface and paint had the strongest bond to each other?
6. Optional - Why do some paints dry faster than others even though temperature and humidity are the same. Hint - compare ingredients.

ADDITIONAL ACTIVITIES: (Optional)

1. Devise an experiment to test the weathering effects on various paints. This could be carried on outdoors over a period of several months or in the laboratory using artificial weather conditions.
2. What would you hypothesize to be the relationship between temperature and the drying time of a certain paint. Devise an experiment in which you could determine what this relationship might be.
3. What would you hypothesize to be the relationship between humidity and the drying time of a certain paint. Devise an experiment in which you could determine what this relationship might be.

TEACHER SUPPLEMENT

MODULE: Kinds of Paints and Different Surfaces

MODULE: Comparing Weights of Motor Oil

CLUSTER: Construction and Repair

OCCUPATION: auto mechanic

CLUSTER: Transportation

OCCUPATION: service station attendant

PREREQUISITES:

Explain the term viscosity in terms of flowability.______________________

OBJECTIVES:

1. Given the necessary materials you can determine how the viscosity of an oil is related to:
   a. the weight number
   b. the temperature
2. After comparing the viscosities of oil samples of various weights, and at different temperatures, you can describe which oil weight should be used for summer, for winter, and why.

EQUIPMENT:

- 10 W motor oil
- 30 W motor oil
- 6 large test tubes with stoppers
- 6 equal pieces of metal shot or glass beads
- °F thermometer
- refrigerator or ice bath
- hot water bath
- clock with sweep second hand

PROCEDURE:

1. Fill each of the test tubes to the top with the specified oil, add the shot or bead, stopper, and place in the stated environment as listed below.

Test Tube	Oil #	Temperature Condition
1	10W	Refrigerator or ice bath
2	30W	Refrigerator or ice bath
3	10W	Room Temperature
4	30W	Room Temperature
5	10W	Hot water bath of about 150 °F
6	30W	Hot water bath of about 150 °F

2. You may want to first test the viscosity of those samples at room temperature while other samples are allowed to cool or heat for 15 minutes.

3. To test the viscosity of each sample, quickly invert the test tube and record the time it takes the shot or bead to fall to the bottom of the oil. Record your results below. The greater the viscosity the slower the particle will fall.

DATA AND RESULTS:

Tube #1	Oil #	Temp. °F	Time - Sec.
1	10W		
2	30W		
3	10W		
4	30W		
5	10W		
6	30W		

EVALUATION:

1. Which oil weight should be used during the summer and why?
2. Which oil weight should be used in the winter and why?
3. How many seconds would it take the bead to fall in 20W oil, at room temperature?

Optional Activity:

Devise a similar experiment in which you measure the effects of temperature on 10-30W motor oil.

MODULE: Comparing Weights of Motor Oil

TEACHER SUPPLEMENT

PREREQUISITES:

Viscosity - Liquids which have a high viscosity flow slowly in comparison to those with a low viscosity. (This is a function of internal friction within the liquid. Density and viscosity are not synonymous. Oil is less dense than water and yet has a greater viscosity.)

EVALUATION:

1. 30W should be used during the summer, since higher temperatures decrease the viscosity and you must use an oil of greater initial viscosity.
2. In winter the 10W would be more satisfactory. Since cold temperatures increase viscosity, you must use oil with a lower amount of initial viscosity. (Many car owners use 10W30 oil which is a mixture of the two weights and useable the year around.)
3. At room temperature the bead in 20W oil should fall at a rate exactly half way between the rates for the 10W and 30W oils.

MODULE: Planning a New School Building

CLUSTER: Construction and Repair

OCCUPATION: architect

PREREQUISITES:

Be able to make drawings to scale:

a. if 1/4" = 1 ft., how long a line would you draw to represent 35 ft.?

b. what would be the drawing dimensions of a 50' x 44' area?

OBJECTIVES:

1. Given the specifications for a particular kind of building, you can design a floor plan to scale following these specifications.
2. Using those same specifications, you can design an alternative floor plan.
3. Using your two alternative floor plans you can describe the advantages and disadvantages of each plan over and against the other.

EQUIPMENT:

pencil and eraser
graph paper
ruler

PROCEDURE:

1. On graph paper and drawn to scale, make a floor plan of a one-story elementary school which meets the following specifications. (Before you begin your drawing, be sure you answer each item in procedure #2)
    a. assume building costs to be $35/sq. ft. on the ground floor
    b. the total cost of the building is $865,000.
    c. 12 classrooms (for 28 children each) of 900 sq. ft. each.
    d. halls must be 10 ft. wide.
    e. any point in the building must be no more than 100 ft. from an outside exit in case of fire.
    f. include media center, gymnasium, cafeteria with kitchen, offices and workroom and individual instruction work area (for music, speech therapy, reading difficulties, etc.) storage, heating plant and janitorial areas and/or other facilities.

g. approximately 1 sq. ft. of lavatory area per student

2. Using the specifications in 1, a-g, determine each of the following:

   a. what is the total area of the school? ______________________

   b. how many students are in the school? ______________________

   c. how much room is used for classrooms? ______________________

   d. how much space is required for lavatory space? ______________________

   e. how much space is left for halls, gymnasium, cafeteria, etc.? __________
   ____

3. On a second sheet of graph paper, draw a second alternative floor plan with different features and lay out.

DATA, RESULTS AND EVALUATION:

1. Compare the advantages of each of the two plans to each other.

2. Compare the disadvantages of the plans to each other.

3. Turn in both plans to your instructor. You will be evaluated on how well your plan meets the specifications.

MODULE: Planning a New School Building

TEACHER SUPPLEMENT

PRETEST:

a. 8-3/4"   b. 12-1/2" x 11"

PROCEDURE:

2. a. \$865,000   \$35/sq. ft. = 24,714 sq. ft.

   b. 12 classrooms x 28 children/classroom - 336 children

   c. 900 sq. ft./classroom x 12 classrooms - 10,800 sq. ft.

   d. 336 children x 1 sq. ft./child - 336 sq. ft.

   e. 24,714 sq. ft. total space - (10,800 sq. ft. for classrooms + 336 sq. ft. for lavatories) = 11,136 sq. ft. for auxiliary areas

MODULE: Analyzing Customer Complaints
on Automobile Performance

CLUSTER: Construction and Repair

OCCUPATION: auto mechanic

auto service advisor

CLUSTER: Transportation

OCCUPATION: service station attendant

PRERESUISITES AND PRETEST:

OBJECTIVES:

1. Given a list of complaints concerning automobile performance, you can through use of reference materials or by drawing on you or an expert's experience with cars:
   a. suggest what is wrong with the car.
   b. describe how the fault could be diagnosed for certain,
   c. describe how the fault could be remedied.

EQUIPMENT:

references on care and repair of automobiles

PROCEDURE:

After carefully considering the complaints in the first column, by using references, your own experience or converstaion with an expert, fill in the information necessary for the other three columns. List your sources below.

Complaint	Possible Causes	Procedure to Determine Cause	Suggested Remedy
Car pulls to one side when the brakes are applied.			
Brakes squeek			

Complaint	Possible Causes	Procedure to Determine Cause	Suggested Remedy
Right turn signal doesn't work			
Too much play in steering wheel			
Temperature warning light on			
Engine runs for a bit after ignition is turned off			
Car will not start			
Heater doesn't work			
Engine stops while car is idling at stop sign			

List your sources of information:

OPTIONAL ACTIVITY: Approximately how much would each repair job cost?

TEACHER SUPPLEMENT

MODULE: Analyzing Customer Complaints on Automobile Performance

MODULE: Determining the Vitamin C Content in Fruit Juice

CLUSTER: Consumer, Foods and Homemaking

OCCUPATION: home economist

dietician

CLUSTER: Public Service & Related Professionals

OCCUPATION: Biochemist

chemist

laboratory technician

PREREQUISITES:

OBJECTIVES:

1. Given the necessary lab materials, you can:
    a. determine the relative amount of vitamin C in each of four samples
    b. rank them as to vitamin C content
    c. make a judgement about the nutritional value of canned compared with frozen orange juice, frozen orange juice compared with frozen lemonade.
2. Given the lab data on a vitamin C test, you can:
    a. decide whether any of the juices tested have a vitamin C content greater than 1%
    b. make a judgement of the nutritional value of freshly squeezed orange juice compared to the juices tested in the lab

EQUIPMENT:

samples of -
- 1% ascorbic acid (vitamin C)
- canned orange juice
- frozen juice
- frozen lemonade

10 ml. graduate cylinder

sheet of white paper

stirring rod

eye dropper

4 - 150 ml. beakers

solution of sodium 2,6 dichloro-indophenol. (The stock solution is made by dissolving 1 gram of indophenol powder in 1000 ml. of distilled water)

Before the addition of vitamin C solutions, a dilute solution should be made using 1 part stock solution of the eye, to 4 parts of distilled water. (10 ml. of this dilute solution will be needed for each juice tested)

PROCEDURE:

1. Adding one drop at a time, see how many drops of 1% ascorbic acid can entirely bleach 10 mls. of dilute indophenol solution. The dye may change to violet, pinkish purple, etc., but keep dropping in the vitamin C until the dye is colorless or light brown with flecks of blue-brown floating in it. Be sure to swirl the dye as you drop in the vitamin C. It helps to hold the beaker over a white sheet of paper to better observe color changes.
2. Record the number of drops added when the bleaching effects stops (the dye is all used up).
3. Test each of your samples three (3) times and calculate the average.
4. Repeat the same procedure, this time dropping canned orange juice into 10 mls. of dilute indophenol.
5. Using this method, determine the vitamin C content in frozen orange juice and frozen lemonade also.

DATA AND RESULTS:

SAMPLE NUMBER OF DROPS OF JUICE NEEDED TO BLEACH DYE

Trial #	1	2	3	AVERAGE
ascorbic acid				
canned orange juice				
frozen orange juice				
frozen lemonade				

1. Rank the four samples (highest to lowest), as to vitamin C content. (Remember: the more juice it took to bleach the dye, the less the vitamin C content)

1.______________________________ 3.______________________________

2.______________________________ 4.______________________________

2. Considering the amount of vitamin C as nutritional value, which is the most nourishing:

   a. canned or frozen orange juice?________________________________

   b. frozen orange or frozen lemonade?________________________________

EVALUATION:

1. Do any of the juices tested have greater than a 1% content of vitamin C?

   ____________________-If so, which one?____________________________

2. If it takes 10 drops of freshly squeezed orange juice to bleach 10 mls. of dilute indophenol, how would you rate the nutritional value of the freshly squeezed orange juice compared to the juices tested in the lab?

3. Additional Activity: Compare the vitamin C content among different brands or various fruit drink products of which vitamin C is an additive.

   a. Determine whether vitamin C content deteriorates with age of opening juice container.

   b. Determine whether vitamin C content is changed by storage at different temperatures.

RESOURCES:

Joseph, Brandwein, Morholt,
A Sourcebook for the Biological Sciences
Harcourt, Brace & Company, 1958, p. 38.

MODULE: Determining the Vitamin C Content in Fruit Juice

TEACHER SUPPLEMENT

SAMPLE DATA:

SAMPLE	NUMBER OF DROPS OF JUICE TO BLEACH DYE
"Real Gold" canned orange drink	50 - 55
"Hi-C" canned lemon-lime	17 - 21
1% ascorbic acid	2 - 3
"Fairway" frozen orange juice	23 - 28
"Tang"	23 - 28
"Fairway" canned orange-grapefruit	27 - 32
"Kool-Aid" lemon	450 ± 30
frozen lemonade	450 ± 30

MODULE: Stain and Spot Removal

CLUSTER: Business and Office

OCCUPATION: laundry worker

CLUSTER: Consumer, Foods, Homemaking

OCCUPATION: homemaker

CLUSTER: Construction and Repair

OCCUPATION: janitor

CLUSTER: Personal Services

OCCUPATION: household worker

PREREQUISITES:

1. Be able to use the library efficiently to find the information you need.
2. Remember to read and follow the directions given on the labels of potentially dangerous chemicals. (Don't forget your safety glasses.)

OBJECTIVES:

1. Given five different identified stains, each on a separate fabric sample, you can remove all or most of the stains with household cleaning products without harming the fabric.

EQUIPMENT:

5 pair of fabric samples, each pair spotted with a different stain

a variety of household cleaners and spot removers

PROCEDURE:

1. Obtain 5 pair of identified stained fabric samples from your instructor.
2. By usind the library or some other reliable resource, find a procedure which is safe for removing each particular stain from each specific fabric.
3. Carry out the spot removal to the best of your ability on one of each pair of stains and show the results to your instructor.
4. Keep the pair of each stain sample as a control for comparison.
5. Record your data and results on the next page.

DATA AND RESULTS: see next page

EVALUATION: Show your data and fabric samples to your instructor.

DATA AND RESULTS:

Stain					
Fabric					
Procedure					
Source of procedure					
Results					

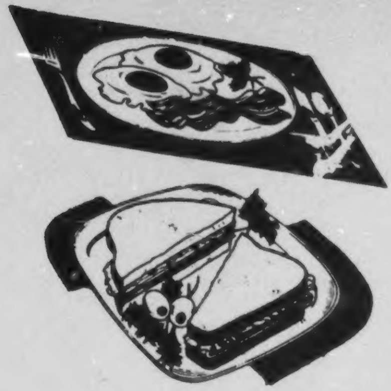
TEACHER SUPPLEMENT

MODULE: Stain and Spot Removal

MODULE: Planning Menus

CLUSTER: Consumer, Foods and Homemaking

OCCUPATION: chef
cook
dietician
home economist
homemaker



PREREQUISITES:

Be able to find reference information concerning the nutritional and caloric value of foods you want to consider placing on your menu.

OBJECTIVES:

1. Given the caloric and nutritional requirements for a given series of meals, you can plan menus which meet these requirements and yet have variety and appeal.

EQUIPMENT: reference books on diet and foods

PROCEDURE:

Considering the following needs based on the findings of nutritional and medical experts:

	TABLE I	
Food Group*		Servings per day
milk		adults, 2 or more; teens 4 or more children 2 - 3
meat		2 or more
fruits and vegetables		4 or more (1 of vitamin C) (1 of vitamin A every other day)
bread and cereal		4 or more

*Check your references for the wide variety of food choices which exist in food group. i.e., milk includes cheese, ice cream, etc.

TABLE II

AGE	SEX	CALORIES NEEDED
Adult	Male	3000
Adult	Female	2200
13 - 15 years	Male	3100
13 - 15 years	Female	2600
5 years	Male or Female	1700
Dieting Adult	Male or Female	1200

Complete the following on extra sheets of paper and turn in to your instructor.

1. Devise three consecutive days of menus for each type of individual listed on Table 2 based on the needs presented in Table 1.
2. While meeting the above requirements, also in designing your menus, consider food costs, availability, time and preparation, and variety.

DATA RESULTS AND EVALUATION:

Submit your menus to your instructor.

TEACHER SUPPLEMENT

MODULE: Planning Menus

MODULE: Leavening Agents - Their Action and Reaction

CLUSTER: Consumer, Foods and Homemaking

OCCUPATION: cook
food technologist
home economist

CLUSTER: Marketing and Distribution

OCCUPATION: bakery worker

PREREQUISITES AND PRETEST:

1. What effect do acids have on the indicator; litmus?________________________

   What effect do bases have on litmus?_______________________________________

   If you do not know, test red and blue litmus with some known acids and bases. (lemon juice and vinegar are acids - household ammonia and dilute sodium hydroxide - lye are bases)

2. Name two leavening agents - materials that cause dough to rise.

   a.___________________________________

   b.___________________________________

3. What is a single acting baking powder?

OBJECTIVES:

1. Given a list of chemicals you can formulate a single acting baking powder that will cause bread dough to rise.
2. Given a container of commercial bakingpowder you can list the ingredients and describe their function.
3. Given a series of conditions including temperature, quantity of baking soda, quantity of water and quantity of some acid salt, you can choose the optium conditions for producing the greatest rise in biscuit dough.

EQUIPMENT AND MATERIALS:

sodium bicarbonate (baking soda) $NaHCO_3$

sodium aluminum sulfate (alum) $NaAl(SO_4)_2$

calcium dihydrogen phosphate $Ca(H_2PO_4)_2$

potassium hydrogen tartarate (cream of tartar) $KHC_2H_4O_6$

water

vinegar or 4% solution of acetic acid

.1M lactic acid or sour milk

several brands of commercial baking powder

red and blue litmus paper

several teaspoons

4 - 50 ml. beakers or small glass containers

PROCEDURE:

1. Action of acids and water with baking soda
   a. test baking soda, water, vinegar and lactic acid with litmus paper. Observe and record.
   b. add 1/4 teaspoon (tsp.) of baking soda to 30 ml. of water. Observe and record your findings.
   c. add 1/4 teaspoon of baking soda to 30 ml. of vinegar (or 4% acetic acid) Observe and record.
   d. if a dilute solution of lactic acid or sour milk is available add a little baking soda to it. Observe and record.
2. Phosphates - $Ca(H_2PO_4)_2$ - Add 1/4 tsp. of calcium dihydrogen phosphate to 20 mls. of water. Test with litmus then add 1/4 tsp. of baking soda. Observe and record. After solution ceases to bubble warm gently again and observe.
3. Alum - $NaAl(SO_4)_2$ - Add 1/4 tsp. of alum to 20 mls. of water. Test with litmus, then add 1/4 tsp. of baking soda to it. Observe and record.
4. Cream of Tartar - $KHC_4H_4O_6$ - Add 1/4 tsp. of cream of tartar to 20 mls. of water. Test with litmus paper, then add 1/4 tsp. of baking soda to it.

5. Effect of heat - Add 1/4 tsp. of baking powder to 30 ml. of cold water and 1/4 tsp. to 30 ml. of warm water. What is the effect of heat on the rate at which gas bubbles are evolved?

DATA AND RESULTS:

MATERIAL	TEST WITH WET LITMUS (acid or base)	REACTION WITH BAKING SODA
1. Baking Soda		
1. Water		
1. Vinegar		
1. Lactic acid		
2. Calcium dihydrogen phosphate		
3. alum		
4. Cream of tartar		

1. What regularities do you observe in the properties of vinegar, alum, calcium dihydrogen phosphate?________________________________

____

2. What could the bubbles of gas be? How could you test this gas to check your guess?________________________________

3. What effect does raising the temperature have on the rate at which the bubbles are evolved?________________________________

____

4. What effect does water have on baking soda? What effect does it have on mono-calcium phosphate? What happens if you mixed dry baking soda

and dry-mono-calcium phosphate together? What happens when you add water to the dry mixture?____

____

5. What other ingredients may be in baking powder besides the above chemicals. Could you test for it? ______________________How?____________

EVALUATION:

Leavening agents were used a very long time before anyone understood their chemical action. They knew by using leavening agents, that bread would rise and become much less dense than the flat unleavened bread. They eventually discovered that the chemical agent which causes dough to rise is a gas which forms in the dough, lifting it as it escapes.

1. Formulate and make your own dry baking powder. (Record your "recipe) on the backside of this sheet)
   a. mix it with some flour, add water, and bake. Record your procedure and observations

   b. Change the amount of one of the ingredients in your bakingpowder, and repeat as in a. Measure the height of the final biscuit product and compare with the biscuit product in a. (Record your second "recipe" on the backside of this sheet)
2. The following chemicals are available to you at home. From these select and underline those you need to make a baking powder that will cause biscuit dough to rise.

   flour
   salt - sodium chloride
   lye - sodium hydroxide
   baking soda - sodium bicarbonate
   milk
   alum - sodium aluminum sulfate
   lemon juice
   mineral oil

3. Obtain a can of baking powder from your home or the grocery store. List all of the ingredients. Describe the function of each ingredient. Is it acid or basic? Is it flavoring? Is it just a "filler"? Is it a source of carbon dioxide gas?

4. Given four conditions circle the combination that you feel would produce the greatest rise in biscuit dough.

a. 1g. $NaHCO_3$
1g. $NaAL(SO_4)2$
10 g. flour
50° F.

b. 1g. $NaHCO3$
1g. $NaAL(SO_4)2$
10 g. flour
1/2 cup water
50° F.

c. 2g. $NaHCO_3$
2g. $NaAL(SO_4)2$
10 g. flour
1/2 cup water
70° F.

d. 2g. $NaHCO_3$
2g. $CA(H_2PO4)_2$
10 g. flour
1/2 cup water
70° F.

MODULE: Leavening Agents - Their Action and Reaction

TEACHER SUPPLEMENT

1. SAMPLE DATA

MATERIAL	TEST WITH WET LITMUS (acid or base)	REACTION WITH BAKING SODA
1. Baking soda $NaHCO_3$	base	none
1. Water - H_2O	neutral	none
1. Vinegar - acetic acid	acid	gas bubbles are evolved
1. Lactic acid	acid	gas bubbles are evolved
4. Cream of tartar $KHC_4H_4O_6$	acid	gas bubbles are evolved (slowly)
2. Calcium dihydrogen phosphate	acid	gas bubbles are evolved (slowly)
3. Alum - $NaAl(SO_4)_2$	acid	gas bubbles are slowly evolved

5. Effect of heat - In procedure 4 warming the solution gently should cause bubbles to again be evolved. $Ca(H_2PO_4)$ is used in most commercial baking powders today. If is a double acting powder. Heating decomposes the dihydrogen phosphate giving off more acid while it bakes.

In procedure 5 the bubbles will be given off more rapidly in the warm water.

II. ANSWERS TO PRETEST QUESTIONS:

1. turns litmus pink
   turns litmus blue

2. a. baking powder
   b. yeast

3. A single acting baking powder is one that will cause bread or biscuit dough to rise because of the evolution of carbon dioxide produced from the single action of acid on baking soda $NaHCO_3$.

ANSWERS TO QUESTIONS IN RESULTS:

1. Vinegar, alum and calcium dihydrogen phosphate are all acids and cause bubbles of gas to be evolved when added to a water solution of baking soda.

2. Carbon dioxide from $2NaHCO_3$ ----- $Na_2CO_3 + H_2O + CO_2$ (g)

   Limewater turns milky when CO_2 is bubbled through it.

3. The higher the temperature the faster is the evolution of carbon dioxide gas.

4. None, none, nothing would happen until water is added.

5. Flour. Iodine test for starch. Iodine turns starch blue-black.

ANSWERS TO QUESTIONS IN EVALUATION:

1. Changing the amount of baking soda will cause the dough to rise more or less depending on the amount added.

2. Flour, baking soda, alum or lemon juice,

3. Baking soda - source of gas - carbon dioxide - base.

4. D - double acting baking powder, 2g of baking soda. Temperature only affects rate.

III. ADDITIONAL INFORMATION:

1. 50 ml. beakers that are roughly graduated make the best containers.

2. If lactic acid is not available let milk stand for a day in the room to make "sour-dough" biscuits.

3. Plastic teaspoons work well and are readily available.

4. Most commercial baking powders are "double acting" phosphate types. It is difficult to find single acting baking powders in stores today even though many people prefer them. "Royal" brand is a single acting powder.

ADDITIONAL ACTIVITIES:

Have the student test baking powders for starch, sulfates, ammonia, and phosphates.

See Laboratory Problems for Living Chemistry, Ginn and Co., Problem 59 for procedures.

Additional references - J. Chem. Ed., Vol. 39, p. 363, July, 1962.

MODULE: Properties and Care of Fabrics

CLUSTER: Consumer, Foods and Homemaking

OCCUPATION: dress maker
home economist
interior designer
model
tailor

PREREQUISITES AND PRETEST:

Remember that sodium hydroxide and dyes are harmful chemicals and can be very damaging to the eyes, skin, and surrounding classroom. Use great caution in handling them.

OBJECTIVES:

1. Given various material samples and other laboratory materials, you can:
    a. test their flamability.
    b. test their stain resistance.
    c. determine their ability to accept dyes.
    d. describe a method to distinguish animal fibers from plant fibers.
    e. describe a method to distinguish natural fibers from synthetic fibers

EQUIPMENT:

5-2" x 2" samples each of white: wool, cotton, nylon*, silk, linen, dacron*

microscope
plain glass slide
Bunsen burner
asbestor sheet
tweezers

tongs
12 - 250 ml. beakers
grape juice, coffee, chocolate (or other common clothing stain)
5% sodium hydroxide (lye)
water

fabric dye solution (made according to the label directions)

paper toweling
eye dropper

*some other synthetic fabrics may be substituted

PROCEDURE:

1. Before beginning this test, devise a method of labelling each fabric sample so you can distinguish it from other fabrics you are working with.
2. Using a tweezers, pull an individual thread from each of the fabric samples. Further dissect and pull apart the thread into individual fibers. Place the fiber on a microscopic slide with a drop of water. Examine these fibers on low-power under the microscope. Look for identifying differences and make a diagram of their microscopic appearance on your data sheet.
3. Place a lighted Bunsen burner on an asbestos sheet. One by one, place each kind of fabric sample half way into the flame for several seconds. Note the speed with which the sample is ignited. Remove the sample from the Bunsen flame. Does it continue to burn? Record any odor present from the fabric. Examine and make note of the ashes. Are they feathery, crispy, like plastic, etc.?
4. Lay one piece of each fabric out on the table top. Place one drop of grape juice, chocolate, or whatever food you are using as a stain, on each of the fabrics. Rinse the stained fabric thoroughly in running water and record the stain intensity which remains as dark, medium, light or none.
5. Place one of each of the samples in a separate beaker of dye solution for 5 minutes. Be sure all samples are submerged below the surface. Remove the samples from the dye, rinse thoroughly under running water, and drain on paper toweling. Record the ability of each fabric to accept the dye as good, poor or none.
6. Place each of the samples in a separate beaker. Cover each sample with about 1/2" of 5% sodium hydroxide and boil them for 5 minutes. Remove the samples from the dye and plunge into a beaker of rinse water. Record the condition of the sample after this test.

DATA AND RESULTS

Microscopic View of Fiber	wool	silk	cotton	linen	nylon	dacron
Flamability						
Odor						
Ability to keep burning after removed from Bunsen flame						
Type of ash						
Stain resistance						
Ability to take dye						
Effect of sodium hydroxide						

EVALUATION:

1. Which fabrics were readily flamable?

2. Which fabrics were relatively stain resistant?

3. Which fabrics would be unsatisfactory for dyeing with commercial clothing dyes?

4. Describe a method to distinguish animal fibers from plant fibers.

5. Describe a method to distinguish natural fibers from synthetic fibers.

MODULE: Properties and Care of Fabrics

TEACHER SUPPLEMENT

ANSWERS TO EVALUATION QUESTIONS:

1. The synthetics usually are the most flamable unless specifically treated for fireproofing. Wool is slow to ignite and fiberglass is flame resistant.
2. The synthetics are usually the most stain resistant.
3. Synthetics do not accept dyes once the fibers are formed and hardened during manufacture. Coloring must be added to the synthetics while they are still in liquid form.
4.

Animal fibers decompose in lye - smell like burning hair	Plant fibers are strengthened by lye - smell like burning leaves

5.

Natural fibers -	Synthetic fibers -
accept dyes	do not accept dyes
burn slowly	burn rapidly
feathery or crispy ash	hard plastic ash
easily stained	stain resistant
microscopically porus and irregular	microscopically like solid rod

MODULE: Using Optical Illusions in Clothing

CLUSTER: Fine Arts & Humanities

OCCUPATION: actor or actress

CLUSTER: Consumer, Foods & Homemaking

OCCUPATION: dressmaker
fashion designer
home economist
model
tailor

PREREQUISITES AND PRETEST:

OBJECTIVES:

1. You can choose various styles and cuts of clothing and accessories which will emphasize or minimize a particular type of body figure.
2. You can sketch clothing and accessories that would emphasize or minimize a particular type of body figure.

EQUIPMENT: pencil
erasor
reference books on fashion

PROCEDURE:

1. In each of the figure types, put + after the style which would emphasize that figure; put - after the style which would minimize that type of figure.
   A. short and slender
      1. full skirt______________.
      2. medium puff or loose sleeves______________.
      3. low U or V neckline______________.
      4. massive jewelry_____________.
      5. small prints______________.

B. Short and stout

1. horizontal lines________________.

2. high square or round, tight fitting collars____________.

3. expose arms and shoulders_____________.

4. large belts, buckles, pockets at waist____________.

5. bold prints and plaids_____________.

C. Tall and angular

1. low V or U neckline___________.

2. beltless____________.

3. straight, tight sleeves___________.

4. very short skirt__________.

5. curved, horizontal lines__________.

D. Hip heavy

1. pockets on skirt___________.

2. wide or contrasting belt____________.

3. full sleeves at shoulders____________.

4. tight, straight skirt____________.

5. high heels__________.

E. Tummy buldge

1. buckles or bows at center front_______________.

2. bright scarf tied high____________.

3. two piece suits_____________.

4. low V shaped neckline____________.

F. Round shoulders

1. hair down and soft in back_________.

2. heavy detail in front________.

3. collarless____________.

4. low round neckline____________.

G. Thick ankles

1. ankle socks_______________.
2. straps across ankles or instep____________.
3. dull finished stockings__________.
4. fancy shoes__________.

H. Large feet

1. flat heeled shoes___________.
2. dull leathers, suede__________.
3. pointed toes__________.
4. broken lines, stitching__________.

I. Large hands

1. dainty bracelets__________.
2. large cuffs_________.
3. large rings________.
4. light fancy gloves____________.

EVALUATION:

1. On each of the following labeled figure pairs on the next pages, sketch clothing and accessories which will minimize/emphasize a particular type of body figure.
2. In the third and fourth columns, list styles to avoid and styles to include for that particular figure.

A. SHORT AND SLENDER FIGURE

		Avoid:	Include:
 Minimized	 Emphasized		

B. SHORT AND STOUT FIGURE

		Avoid:	Include:
 Minimized	 Emphasized		

C. TALL AND ANGULAR FIGURE

 Minimize	 Emphasize	Avoid:	Include:

D. HIP HEAVY FIGURE

 Minimize	 Emphasize	Avoid:	Include:

RESOURCE: Ryan, Mildren, Your Clothes and Personality, Appleton - Century Crofts, Inc. N.Y.

MODULE: Using Optical Illusions in Clothing

TEACHER SUPPLEMENT

PROCEDURE:

A.	1. -	2. +	3. -	4. -	5. +
B.	1. -	2. -	3. -	4. -	5. -
C.	1. -	2. -	3. -	4. -	5. +
D.	1. -	2. -	3. +	4. -	5. -
E.	1. -	2. +	3. -	4. -	5. -
F.	1. -	2. -	3. -	4. -	
G.	1. -	2. -	3. +	4. -	
H.	1. -	2. +	3. -	4. +	
I.	1	2. -	3. +	4. -	

EVALUATION: (These are only a few possibilities.)

A. Short and slender -

Avoid:	Include:
High, round, square necklines	low V or U neckline
puff or loose sleeves	long, tight sleeves
skirts too tight or full	small prints
huge prints	dainty jewelry
massive jewelry	

B. Short and stout -

Avoid:	Include:
horizontal lines	long vertical lines
high, square, round, tight necklines	small V or heart necklines
exposure of arms and shoulders	shoulder cover
large belts and buckles	small belts, same as dress
pockets at waist	long, straight sleeves
short puffy sleeves	
cuffs	

circular skirts

bold prints and plaids

ruffles

C. Tall and angular

Avoid:	Include:
straight, vertical lines	curved, horizontal lines
low V or U necklines	round, oval, heart, necklaces
narrow belts of same material	wide belts
beltless	contrasting waist and skirt
long, straight, tight sleeves	puff, bell sleeves
straight, tight very short skirts	flared, circular, draped skirt

D. Hip heavy

Avoid:	Include:
horizontal, curved lines	vertical, straight lines
round, oval necklines	neck and shoulder interest
low, waist lines	light top, dark skirt
wide belts	broad collars
tight, straight, draped skirts	sleeves full at shoulders, tight at wrist
skirt pockets	
high heels	

MODULE: Wildlife Census Taking

CLUSTER: Agri-business & Natural Resources
Environment

OCCUPATION: conservation officer
wildlife worker
ranger - manager
wildlife manager

PRETEST: None

OBJECTIVE: Given materials the student can:

a. compare the size of an animal population in one area with the population in another.

b. compare the size of a population at one time with the size of the same population at another time.

EQUIPMENT: clip board binoculars (optional)
data sheets

PROCEDURE I:

Many times a wildlife manager is not concerned so much with knowing exactly how many animals there are in a population. He would rather know whether the population is growing or getting smaller. He might also want to compare the size of a population of animals in one area with the size of a population in another area.

1. Choose an animal that is easily visible that is found in your community. (Suggestions: dogs, cats, squirrels, birds, people, kids, etc.)
2. Choose two areas in your community that you would like to compare.
Example: Birds - compare the bird population near the freeway with the bird population 1 or 2 blocks away from the freeway.
3. Walk through each area and count the number of animals (birds, dogs, or cats, etc.) that you see in a certain time span (10,15,20 minutes), and record this in Table One.

DATA AND RESULTS:

TABLE ONE:

COMPARISON OF POPULATIONS IN TWO AREAS

NAME OF ANIMAL	LOCATION	TIME SPAN	NUMBER OF ANIMALS

EVALUATION:

1. What conditions caused the differences in the populations observed?

2. How have the activities of man influenced the population differences that you have observed?

PROCEDURE II:

If you would like to know what time of the day a certain kind of animal is most active in one area you can do the following:

a. choose an animal to study.

b. choose **a location** in which to study this animal.

c. choose two times of the day that you would like to compare.

d. walk through this same area during the two times periods of the day, and record the number of animals you see in Table Two.

DATA AND RESULTS:

TABLE TWO:

COMPARISON OF TIME OF DAY ACTIVITY

ANIMAL NAME	TIME OF DAY	TIME SPAN	NUMBER OF ANIMALS

EVALUATION:

1. What conditions caused the differences in the populations observed?

2. How have the activities of man influenced the population differences that you have observed?

TEACHER SUPPLEMENT

MODULE: Wildlife Census Taking

176A

MODULE. Setting up a Nature Trail

CLUSTER: Hospitality and Recreation

OCCUPATION: recreation worker

CLUSTER: Environment

OCCUPATION: forestry technician

CLUSTER: Agri-Business

OCCUPATION: manager-wildlife

CLUSTER: Natural Resources

OCCUPATION: wildlife worker

PREREQUISITES: Ability to identify plants and animals with the help of nature guides.

OBJECTIVES:

1. Given an area of land you can set up a nature trail without damaging the existing ecology, except for the path and observation areas.
2. Given an area of land you can set up a nature trail which shows:
   a. plants in seasonal change that produce leaves, bloom, produce fruit and lose their leaves or die.
   b. plants which share similar micro environments.
   c. plants which require differing environments.
   d. animals and/or evidence of animals throughout the year.
   e. plant and animal interdependence.

EQUIPMENT:

materials to make a nature guide
metal or wood posts
hammer to pound the post
metal or plastic number tags
plant and animal guides for the area i.e.:

Murie, O. "Field Guide to Animal Tracks", Houghton Mifflin, Boston, 1954
Hausman, L., "Beginners Guide to Freshwater Life," Putnam's, N.Y., 1950

Graves, A., "Illustrated Guide to Trees and Shrubs", Harper & Row,
N.Y., 1956
Burt, W. and Grossenheider, R., "A Field Guide to the Mammals",
Houghton Mifflin, Boston, 1952
Gunderson and Beer, "The Mammals of Minnesota", University of Minnesota
Press, Minneapolis, 1953
Breckenridge, W. J., "Reptiles and Amphibians of Minnesota", University
of Minnesota Press, Minneapolis

PROCEDURE:

This project probably requires several groups of students working on it and can show the interdependence of several careers. Biologists and wilflife managers need to identify the plants, animals, and swamp or pond life and plant other interesting vegetation. Ecologists, while helping with the identification, should plan the trail(s) location to minimize destruction of the existing life. Some artistic and esthetic planning should go into the marking and arrangement of each stop along the path. Someone who writes clearly should be in charge of preparing the guides describing what may be seen at each station along the trail.

1. Select an area close to or on the school grounds where you have observed plentiful plant and animal life. Make sure that you get permission in writing to use the property.
2. Some suggestions for making the trail are:

   Note: You should not bring in plant or animal species typical to the area unless you first check on their possible harmful effects and then note that they are typical in your guide and trail markings.

   a. plant some trees and shrubs, typical to the area, in appropriate places and record their growth. They could be measured periodically.
   b. plant annual and perennial flowers, typical to the area, and in a shady area with moist, slightly acid soil, plant some ferns, mosses, and spring flowers.
   c. reproduction in different flowers, variations, and evolutionary sequence may be seen if there are magnolia, forsythia, different cherry trees, flowering crabs, different maples, dogwood, elm, oak or barberry. Include witch hazel because of its fall blooming.

d. one suggestion for markers would be to make bird houses and number them, as well as post-markers showing directions visible year around.

e. the trail itself may be cut with a lawn mower. A mulch of wood chips, sawdust, or leaves may be used to maintain the trail*. A spot of yellow or white paint sprayed on trees along the route may help show the way.

f. prepare specific associations of plants and animals to show interdependence such as: a decaying log with its ants, termites, and worms, etc.

g. prepare some animal areas such as a pile of brush for rabbits, compost pile for worms, bacteria, insects, etc., and a small pond made by a low dam or stream.

h. make trail guides describing the plants, animals, and relationships observable at each station rather than putting all that information on a tag at the station. Your guides will be more accurate and interesting if you prepare one for each season. Your trail guide should be usable by inexperienced students so make it over complete rather than just sketchy descriptions.

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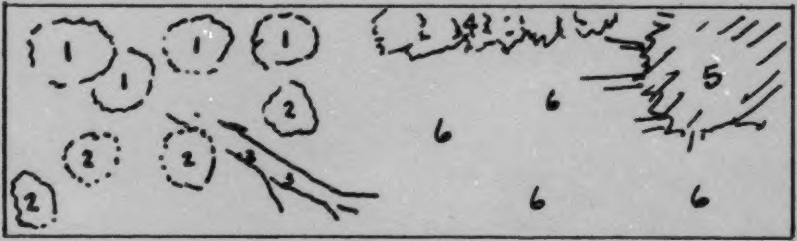
*check with N.S.P. or Northwestern Bell for wood chips.

TRAIL GUIDE STATION EXAMPLE

Station Seven



trail station marker

1. red maples
2. white oak
3. lichen on fallen white oak
4. barberry bush
5. brush pile
6. white clover

Look for squirrels in the oaks and on the ground. Rabbits may be in or near the brush pile or eating clover. Look for downy woodpeckers on the oaks.

Ecology: The lichen is an example of mutualism where two organisms (algae and fungi) live together to benefit each other. The barberry bush is a host of wheat rush so is destroyed in wheat producing areas.

RESULTS:

Prepare your guides in a manner which will be easy to carry and not affected much by wind and rain. Example: Use water resistant covers for index cards. Enlist an active group of people who will maintain the trail and make additions and corrections to the guide.

EVALUATION:

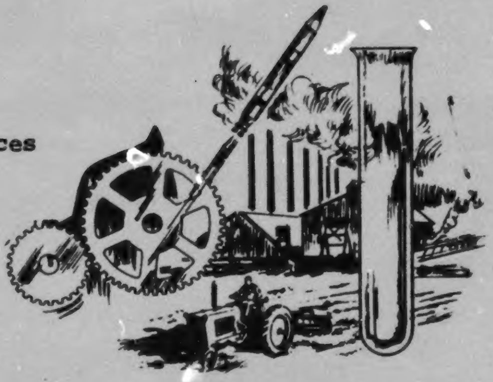
When you have completed the trail and guide take your teacher through the paths. Check to see if he can easily find the things you have noted in the guide.

Note: An excellent resource is the Environmental Science Center
5400 Glenwood Avenue
Minneapolis, Minnesota 55422
612-544-8971

TEACHER SUPPLEMENT

MODULE: Setting Up a Nature Trail

MODULE: Autoradiography I -
Technique for Making Pictures
with Radiation



CLUSTER: Agri-Business and Natural Resources

OCCUPATION: agricultural engineer

agronomist

crop and soil scientist

engineer - mining

horticulturist

CLUSTER: Environment

OCCUPATION: engineer - nuclear

CLUSTER: Public Services and Related Professions

OCCUPATION: bio-chemist

physicist

physics teacher

CLUSTER: Health

OCCUPATION: micro-biologist

physician

radiologic technologist and X-ray technician

PREREQUISITES AND PRETEST:

OBJECTIVES:

You can make an autoradiograph of a luminous clock dial.

EQUIPMENT: polaroid film (type 57, 4 x 5, 3000 speed)

luminous clock-face dial

roller or other means to spread the developing chemicals

PROCEDURE:

1. Lay out your unopened film on the table, face up.
2. Place the clock dial face down on top of the film.
3. Place a book on top of the clock dial to hold it in place.
4. Allow the film to be exposed to the radiation for 24 hours.

5. Develop the film by spreading the developing chemicals across the emulsion by the following method (a job best left to your teacher).
   a. open a drawer part way. (Make sure that the top of the drawer and the top drawer jam are smooth).
   b. place the film in the opening with the pull tab extended out of the drawer.
   c. close the drawer so that it applies an even pressure across the film.
   d. pull the film out of the drawer while you are maintaining this pressure across the film. This should distribute the developing fluid.
   e. allow the film to develop for 10 seconds.
   f. if the film is not evenly developed, you need to practice your technique.

   Note: You may also use a roller to distribute the developing chemicals.

DATA AND RESULTS:

1. Do the numerals show up very clearly or are they hazy?
2. If the numerals are hazy what could be done to make them more sharp?
3. If the numerals did not show up very well, what could you do differently?

ALTERNATE METHOD: Using X-ray film.

EQUIPMENT: X-ray film
dark room facilities
luminous clock-face dial
light proof paper

PROCEDURE:

1. Place the clock dial face down on top of the film.
2. Wrap X-ray film and the luminous clock dial in the light proof paper.
3. Allow the film to be exposed to the radiation for 24 hours.
4. Develop the film according to the direction on the film package.

MODULE: Autoradiography I - Technique for Making Pictures with Radiation

TEACHER SUPPLEMENT

ANSWERS:

DATA AND RESULTS:

1.
2. Longer exposure, or shorter exposure, depending on the intensity of the exposure. Arrange the set up so that the clock dial is closer to the film.
3. Longer exposure.

EQUIPMENT: luminous clock-face dials

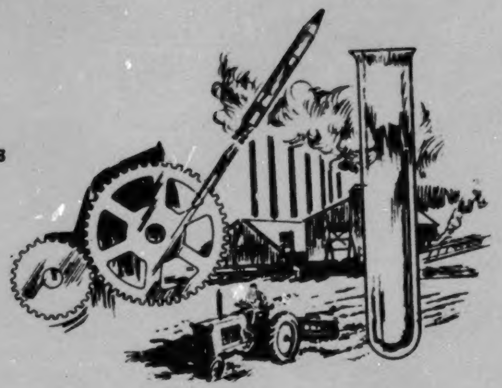
radium excitation $.95

Westclox

Division of General Time Corporation
LaSalle, Illinois 61301
Department No. 764

Polaroid film - type 57, 4 x 5, 3000 speed — $7 pkg. purchase from your local camera shop

X-ray film - Kodak no-screen X-ray film, 5 x 7" size in boxes of 25 sheets



MODULE: Autoradiography II - Using Plants

CLUSTER: Environment

OCCUPATION: nuclear engineer

CLUSTER: Agri-Business & Natural Resource

OCCUPATION: agricultural engineer
agronomist
crop & soil scientist

PREREQUISITES AND PRETEST: Module: Autoradiography I - Technique for making pictures with radiation. Teacher that is familiar with general laboratory radiation safety regulations, and the conditions for general license for the possession and use of radioactive by-product materials. (See teacher supplement at the end of this activity).

OBJECTIVES: The student (under the supervision of his teacher) can make an autoradiograph of a plant showing the absorption of p^{32} by the plant.

EQUIPMENT: small plant such as a small tomato plant, coleus plant or a celery stalk with leaves

solution of p^{32} (10 microcuries)

2 sheets of X-ray film each wrapped in Saran Wrap
or
one sheet of Polaroid film, type 57 4 x 5, 3000 speed

absorbent paper (paper towel)

light proof paper

PROCEDURE:

1. Place the stalk or roots of the plant in the solution of p^{32} for a period of at least 6 hours.
2. Trim the roots from the plant and place the plant between 2 sheets of absorbent paper and press in a large book for at least several hours.
3. Place the pressed plant between the two sheets of wrapped X-ray film and wrap with light proof paper. (This procedure must be done in the dark) Or lay the plant out on a piece of Polaroid film and press down with a book. Allow the film to be exposed for 48 hours or more.

4. Develop the film. For the Polaroid film see Module: Autoradiography I. For the X-ray film, follow the instructions that come with the film.

DATA AND RESULTS:

1. In what part of the leaves was the p^{32} concentrated?
2. Did some parts of the plant receive more p^{32}? Which parts?

EVALUATION:

Why do you think the p^{32} collected where it did?

Reference: Schenberg, Laboratory Experiments with Radioisotopes for High School Demonstration, U.W. Atomic Energy Commission, 1968.

Science Teachers Handbook, U.S. atomic Energy Commission

TEACHER SUPPLEMENT

MODULE: Autoradiography II - Using Plants

ANSWERS:

DATA AND RESULTS:

1. In the "veins" of the leaves.

2. Varies with the condition and type of plant. If the plant is growing it (p^{32}) may be attracted to the growth areas. If not, p^{32} may be absorbed by the lower leaves first, etc.

EVALUATION:

See Number 2 above.

FURTHER ACTIVITY:

One method would be to pluck off leaves from the middle of the plant at 15 minute intervals.

TEACHER SUPPLEMENT

MODULE: Autoradiography II

REGULATIONS:

The regulations regarding license for the possession of reactor-produced radioactive isotopes are entitled "Title 10, Part 30, Licensing of Byproduct Material".

The Atomic Energy Commission's radiation safety regulations are entitled "Title 10, Part 20, Standard for Protection Against Radiation".

Both sets of regulations may be obtained by writing the Atomic Energy Commission, Dividion of Licensing and Regulation, Washington 25, d.c.

LICENSE FOR THE TEACHER:

In most cases sufficient amounts of radioactive isotopes for high school laboratory use can be covered by a general license. Each teacher that meets the following prerequisites is automotically licensed:

1. You must meet the conditions of the general license as set forth in Section 30.21 of the above licensing regulation.
2. You must follow the Atomic Energy Commission's radiation safety regulations.

EQUIPMENT:

*Suppliers of Radio isotopes free of U.S.-A.E.C. Licensing Regulations

Abbott Laboratories
Radio-Pharmeceutical Operations
Abbott Park
North Chicago, Illinois 60064

Atomic Research Laboratories
7901 San Fernando Road
Sun Valley, California 91352

Baird-Atomic, Inc.
33 University Road
Cambridge, Massachusetts 02138

Nuclear-Chicago Corporation
333 East Howard Avenue
DesPlaines, Illinois 60018

Nuclear Equipment Chemical Corporation
145 Florida Street
Farmingdale, Long Island, New York 11735

U.S. Nuclear Corporation
P.O. Box 208
Burbank, California 91502

*Information provided by the U.S. Atomic Energy Commission.

REFERENCE MATERIALS:

Laboratory Experiments with Radio Isotopes for High School Science Demonstration, U.S. Atomic Energy Commission

Science Teachers Handbook, U.S. Atomic Energy Commission

**Illustrations of Radio Isotopes, Definitions and Applications, U.S. Atomic Energy Commission

**A good source for career information.

MODULE: Autoradiography III - Using Animals

CLUSTER: Agri-Business and Natural Resources

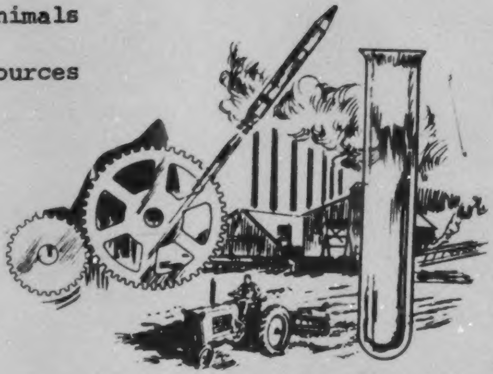
OCCUPATION: agricultural engineer
cattlemen

CLUSTER: Environment

OCCUPATION: nuclear engineer

CLUSTER: Health

OCCUPATION: doctor
radiologic technologist & X-ray technician



PREREQUISITES AND PRETEST: Refer to the prerequisites for Autoradiography II - Using Plants

OBJECTIVES: The student (under the supervision of his teacher) can make an autoradiograph of an animal using radio isotopes.

EQUIPMENT AND MATERIALS:

live frog or other small animal

one or all of the following solutions: p^{32}, 1^{131}, Na^{22}, Z65, or Fe^{59} (10 microcuries)

syringe and needle

X-ray film wrapped in light proof paper and darkroom facilities
or
Polaroid film - type 57, 4 x 5, 3000 speed

means of sacrificing* the frog

plastic wrap - like Saran Wrap

*The term "sacrificing" is used in experimenting with animals when they are to be killed to show that their lives were given for a productive reason and not just destroyed carelessly. Life is precious and should never be wasted.

PROCEDURE:

1. Have your teacher inject one of the radio isotopes just under the skin of the abdomen of the live frog.

2. Allow the radio isotope to become absorbed by the frog for about 24 hours.
3. Have your teacher sacrifice the frog for you.
4. Flatten the killed frog out and wrap him up in a piece of plastic wrap.
5. Place this preparation on a piece of film, holding the frog in position by pressing him with a heavy book.
6. All the film is to be exposed for at least 24 hours and then developed. Place the frog in a cool place while the film is being exposed.

DATA AND RESULTS:

In what areas of the frog's body did the radio isotope accumulate? (Tape the picture on this page)

ANIMAL AUTORADIOGRAPH

EVALUATION: Why do you think the radioactive material collected in the places that it did?

Reference: Schenberg, Samuel (Ed), Laboratory Experiment with Radio Isotopes for High School Demonstration, U.S. Atomic Energy Commission, 1968.

TEACHER SUPPLEMENT

MODULE: Autoradiography III - Using Animals

DATA AND RESULTS:

P^{32} - bones (used by the bones)

I^{131} - thyroid glands (used by the thyroid gland)

Na^{22} - distributed all over the body (generally used all over the body)

Z^{65} - remain in abdomen (not generally useful to the body)

Fe^{59} - outline the circulating system (part of the blood)

EVALUATION:

See Data and Results

REGULATIONS: EQUIPMENT: REFERENCE MATERIALS

Refer to the teacher supplement at the end of Module:

Autoradiograph II - Using Plants

MODULE: The Effects of Radiation on Plants - Seeds

CLUSTER: Environment

OCCUPATION: nuclear engineer

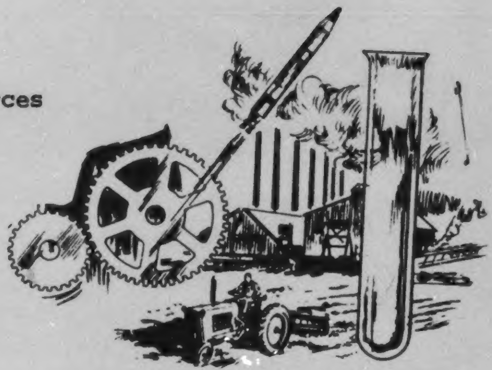
CLUSTER: Agri-Business & Natural Resources

OCCUPATION: agricultural engineer

agronomist

crop & soil scientist

horticulturist



PREREQUISITES AND PRETEST:

OBJECTIVES:

EQUIPMENT AND MATERIALS:

2 - plant flats prepared for growing seeds

irradiated seeds* } both of the same type of plant
non-irridated seeds

*Get a list of sources of irradiated seeds from your teacher if seeds are not furnished for you.

PROCEDURE:

1. Plant irradiated seeds in one flat and allow to grow to maturity.
2. Collect the seeds from the matured plants and replant in a flat.
3. Plant non-irradiated seeds in one flat to serve as a control.
4. Some effects may be noted in the first growth; however, they usually appear in the second and subsequent generations.

DATA AND RESULTS:

1. What effects if any were noted in the first planting?
2. What effects did you observe in the second planting?

Reference: Science Teacher's Handbook, U.S. Atomic Energy Commission

MODULE: The Effects of Radiation on Plants - Seeds

TEACHER SUPPLEMENT

ANSWERS:

ata and results;

Refer to: What Can You Expect from Atomic Irradiated Seeds?, U.S. Atomic Energy Commission

Some Suppliers of irradiated seeds*

Carolina Biological Supply Company
Burlington, North Carolina

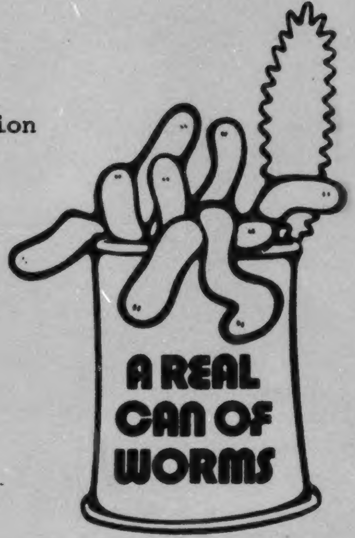
General Biological Supply House
8200 South Hoyne Avenue
Chicago 20, Illinois 60620

Oak Ridge Atom Industries
Elza Drive
Oak Ridge, Tennessee 37830

Powell Laboratories
P.O. Box 7
Gladstone, Oregon 97027

Wards Natural Science Est., Inc.
3000 Ridge Road East
Rochester, New York 14621

*Information provided by the U.S. Atomic Energy Commission


A REAL CAN OF WORMS

MODULE: Soil Microorganisms and Soil Pollution

CLUSTER: Agri-Business and Natural Resources Environment

OCCUPATION: agricultural engineer

agriculture extension agent

CLUSTER: Agronomist

OCCUPATION: crop and soil scientists

CLUSTER: Farmer

OCCUPATION: conservation officer

PRETEST AND PREREQUISITES: Module: "Media Preparation, Bacteria and Mold Culture Growth"

OBJECTIVE:

Using the procedures used in the prerequisite module, you can determine the effects on soil microorganisms of the various methods of crop and soil management.

EQUIPMENT AND MATERIALS:

- soil samples of equal size -
  - virgin soil (organic soil)
  - soil on which chemical fertilizer has been used for several years
  - soil on which chemical herbisides have been used for several years
- Petri dishes containing a nutrient culture medium (See Module: "Media Prep-Bacteria and Mold Culture Growth")
- inoculating loop
- Bunsen burner

PROCEDURE:

1. Using the procedures described in Module: "Media Prep-Bacteria & Mold Culture" determine which type of the three soils has the most abundant microorganism. In order to innoculate the media, place one pinch of the soil on the surface.
2. When you collect the soil samples, make notes as to the abundance of other animals such as worms, arthropods, and insects.

3. Make a descriptive comparison of the three soil types on the chart which follows:

DATA AND RESULTS:

Soil Type	Small Animals Abundance and Types	Microorganisms Abundance and Types
Virgin (Organic)		
Containing Chemical Fertilizer Over a Period of Years		
Containing Chemical Herbicides Over a Period of Years		

EVALUATION:

1. Which soil sample had the most abundant plant and animal life?

   Which had the least abundant?

2. If soil were considered a living thing, which soil sample was the most alive:

3. If soil has to be alive to do its job of growing crops best, which of the three kinds of soil you tested would you like to have?

TEACHER SUPPLEMENT

MODULE: Soil Microorganisms and Soil Pollution

MODULE: Determination of Dissolved Oxygen Content in Water

CLUSTER: Agri-Business & Natural Resources

OCCUPATION: wildlife - manager

CLUSTER: Environment

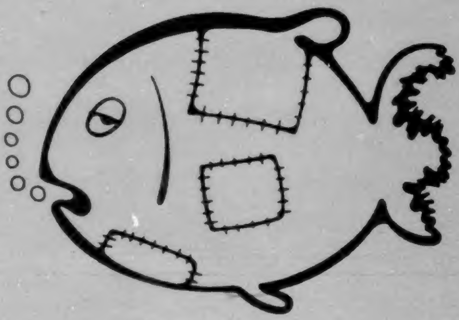
OCCUPATION: water management technician

CLUSTER: Marine Science

OCCUPATION: oceanographer

CLUSTER: Public Service

OCCUPATION: chemist



PREREQUISITES:

1. Explain the following in your own words:
    a. chemical precipitate ____________________
    b. solution ____________________
    c. cc. ____________________
2. Be especially careful in using chemical solutions. Many of those included in this experiment are very caustic to eyes, clothes, skin, etc. Use safety glasses.
3. Remember 1 ml. is equal to 20 drops. This may help you in making some of the small volume measurements.

OBJECTIVES:

1. Given a water sample and the necessary lab equipment, you will be able to experimentally determine the amount of dissolved oxygen in the sample in parts per million.
2. Given the necessary lab data, you can calculate the amount of dissolved oxygen of the sample described in p.p.m.

EQUIPMENT: concentrated sulfuric adic, H_2S04 (to be dispensed by instructor)

potassium permanganate solution
(1.6 gm. $KMnO_4$ in 250 mo. of H_2O).

potassium oxalate solution
(5 gm. $K_2C_2O_4$ dissolved in dist. water. Add 1 gm. NaOH and dilute to 250 ml. with water)

manganous sulfate solution
(12 gm. $MnSO_4 \cdot 4H_2O$ to 25 ml. liter H_2O)

hydroxide sodium hydroxide solution
(50 gm. NaOH and 13.5 gm. NaI to 100 ml. of H_2O)

sodium thiosulfate (0.1 N is 6.1 gm. $Na_2S_2O_3 \cdot 5H_2O$ to 250 ml. of H_2O. Use cooled boiled H_2O. Add 1 cc. of chloroform. When this is to be used, this stock solution to .01 N. by adding 9 parts water to 1 part of this solution)

starch solution
(1 gm. of corn or potato starch is added to 200 ml. of boiling water and cooled to room temperature. Allow to stand overnight and use only the clear fluid from the upper part of the container)

150 ml. of a water sample (from aquarium, lake, pond, etc.)

burette, graduated pipette, or syringe

100 ml. graduate

125 ml. Erlynmeyer flask with rubber stopper

10 ml. graduate

balance

medicine or eye dropper

400 ml. beaker

PROCEDURE:

1. Fill to overflowing, a sampling bottle completely full of sample water. Avoid splashing, bubbling, or heating the water throughout this test. Immediately cover the sample making sure no air bubble is present in the bottle. Carry out all additions to the sample in a sink as there will be overflows.

2. The Rideal Stewart, modified Winkler test will be used to determine the amount of oxygen in parts per million in the water analyzed. In completing the next five steps (3 through 7), do not leave the bottle unstopped or uncovered any longer than necessary.

3. Add the following to your water sample: 14 drops conc. H_2SO_4, 1.0 cc. $KMnO_4$ solution.

4. Shake well. A pale violet or pinkish color should occur and be maintained. If it fails to develop or tends to disappear, add an additional cc. of the $KMnO_4$ solution. Shake. After the desired color is obtained, the sample should be allowed to stand for at least 40 minutes.

5. Add 1 cc. of potassium oxalate solution. Shake. Allow to stand until the color disappears.

6. Add 1 cc. manganous sulfate solution and 3.0 cc. of hydroxide sodium iodide solution. Shake. A yellow precipitate should form. Allow to partially settle. Then shake again.

7. Add 10 drops concentrated H_2SO_4. The precipitate should dissolve. If not add an additional 10 to 15 drops of acid. Shake. The yellowish color that remains represents the iodine that has replaced the dissolved oxygen. If necessary or if desired, the procedure may now be halted and the remaining steps completed during a subsequent period.

8. Measure out 100 cc. of your treated sample and place in a 400 ml. beaker. Using a burette, graduated pipette or syringe, add sodium thiosulfate solution one drop at a time, until a very pale yellow color is obtained. RECORD THE AMOUNT OF SODIUM THIOSULFATE ADDED. Stir or swirl the sample constantly while you add the sodium thiosulfate drop by drop. Place a white sheet of paper under the water sample so you better observe color changes.

9. Add 2 cc. of starch solution. The sample should turn blue.

10. Continue to add sodium thiosulfate in small quantities until the sample becomes clear and remains clear even when the sample is stirred or mixed. RECORD THE AMOUNT OF SODIUM THIOSULFATE ADDED.

11. Calculate the total amount of sodium thiosulfate added in cubic centimeters. The answer is approximately equal to the parts per million of dissolved oxygen in the water sample.

12. To find the amount of dissolved oxygen in parts per million, multiply the total amount of sodium thiosulfate added by 4/5 or .8.

DATA AND RESULTS:

The total amount of sodium thiosulfate added = ________________________cc.

X 0.8

The dissolved oxygen in parts per million = ________________________.

EVALUATION:

1. If 9 cc. of sodium thiosulfate is needed to discolor 100 cc. of a treated water sample, what is the amount of dissolved oxygen in the sample expressed as parts per million?

2. Why does the procedure caution you against heating the sample?

3. Why does the procedure caution you against splashing or bubbling the sample?

4. Additional Activity: Rank the types of water in comparison with each other as to oxygen content. (1 = highest amount of oxygen). Test two or more types of water in the lab and check out your prediction.

tap water
river or stream water
lake water
pond water
aquarium water (with air pump)
aquarium water (with live plants)
distilled water
freshly melted snow

MODULE: Determination of Dissolved Oxygen Content in Water

TEACHER SUPPLEMENT

PREREQUISITES:

1. a. chemical precipitate - solid material which settles out of a liquid.

   b. solution - a liquid containing a dissolved substance.

   c. cc. - cubic centimeter or one milliliter.

EVALUATION:

1. 9 cc. X 0.8 = 7.2 parts per million.

2. Heating would tend to drive any dissolved gases out of solution. You know what happens to a bottle of warm pop.

3. Splashing or bubbling would allow additional oxygen to dissolve in the sample and you would get an inaccurate reading for your original sample.

SAMPLE DATA:

Sample	Oxygen content
aquarium water areated with pump	4.9 p.p.m.
tap water	3.7 p.p.m.
distilled tap water	2.5 p.p.m.

MARINE SCIENCE

NOTE: TO THE TEACHER

Most classrooms are not set up for the performance of activities involving the use of marine animals. It therefore would be useless to include these kinds of activities in this book. However, many students find the ocean intreging and perhaps the introduction of a marine aquarium into your classroom would be a very nice supplement to your curriculum. With an investment of less than $100 you could set up a 20 gallon marine aquarium complete with animals. The following two activities should be helpful in getting you started.

MODULE: Setting Up and Maintaining A Marine Aquarium

CLUSTER: Marine Science

OCCUPATION: diver

fisherman

oceanographer

OBJECTIVES:

1. Write for the information necessary to set up a marine aquarium.
2. Devise a plan to set up a marine aquarium in either the classroom or at home.
3. Set up and maintain a marine aquarium.

PREREQUISITES: Show the ability and knowledge to set up and maintain a fresh water aquarium.

EQUIPMENT AND PROCEDURE: Write to your biological supply house and request information for the setting up of a marine aquarium. Some reliable sources are:

Aquarium Systems, Inc.
33208 Lakeland Blvd.
Eastlake, Ohio 44094

Carolina Biological Supply Company
Burlington, North Carolina 27215

or

Gladstone, Oregon 97027

Pets Unlimited
Institutional Sales Division
903 Hennepin Avenue
Minneapolis, Minnesota 55403

Books and Pamphlets:

Diehl, F.A., Feeley, S.B. and Gibson, D.C., Experiments Using Marine Animals

Aquarium Systems, Inc.
Eastlake, Ohio 1971 $ 4.50

James, Daniel D., Try a Marine Aquarium "Carolina Tips" 1972, 35, 1. Carolina Biological Supply Co. Free on request

James, Daniel E., Maintenance and Media for Marine Algae, "Carolina Tips", 1969, 32,45. Carolina Biological Supply Co. Free on request.

James, Daniel E., Maintaining the Marine Aquarium, "Carolina Tips" 1972, 35, 2. Carolina Biological Supply Co. Free on request.

Spotle, Stephan H., Fish and Invertebrate Culture: Water Management in Closed Systems., Wiley-Interscience, New York 1970.

Straughan, Robert P.L., The Salt-Water Aquarium in the Home, 2nd edition, A.S. Barnes and Co., New York, 1970.

Morhalt, Evelyn, Paul F. Brandwein, Alexander, Joseph, A Sourcebook for the Biological Sciences, 2nd edition Harcourt, Brace & World, Inc., New York, 1966.

EVALUATION:

1. How many of your letters were answered? How many were not answered?
2. Do you feel that you were able to collect enough information to set up your marine aquarium.
3. Show your plan for setting up a marine aquarium to your teacher and have him go over it with you. Make sure that you include a list of the things that you will need as well as the cost.

TEACHER SUPPLEMENT

MODULE: Setting Up and Maintaining A Marine Aquarium

MODULE: Experiments Using Marine Animals

CLUSTER: Marine Science

OCCUPATION: diver

fisherman

oceanographer

PREREQUISITES: Ability to set up and maintain a marine aquarium.

OBJECTIVES:

1. You can handle and work with marine animals.
2. You can set up and perform experiments which try to answer questions about marine animals.

PROCEDURE:

1. Refer to the book Experiments Using Marine Animals, Fred A. Diehl, James B. Feelay and Daniel G. Gibson, authors.
2. If this book is not available to you in your classroom, write or call your nearest squarium dealer that handles marine animals. A goodplace to write or call is:

Pets Unlimited
Institutional Sales Division
930 Hennepin Avenue
Minneapolis, Minnesota 55403
or
Write to the publisher:
Aquarium Systems, Inc.
33208 Lakeland Blvd.
Eastlake, Ohio 44094

EVALUATION:

For each experiment you perform write a short report that contains:

1. The question you are trying to answer.
2. The procedure that you followed.
3. Al of your data.
4. Your conclusion.

TEACHER SUPPLEMENT

MODULE: Experiments Using Marine Animals

MODULE: Preparation of Solutions of a Given % Concentration

CLUSTER: Agri-Business & Natural Resources

OCCUPATION: farmer

florist

CLUSTER: Communications & Media

OCCUPATION: photographer

CLUSTER: Consumer, Foods & Homemaking

OCCUPATION: home economist

CLUSTER: Manufacturing

OCCUPATION: electro-plater

CLUSTER: Personal Services

OCCUPATION: cosmetologist

CLUSTER: Public Services & Related Professionals

OCCUPATION: bio-chemist

chemist

mortician

science teacher

CLUSTER: Medicine & Health

OCCUPATION: dental assistant

medical technologist

pharmacist

X-ray technician

CLUSTER: Business & Office

OCCUPATION: dry cleaner worker

CLUSTER: Transportation

OCCUPATION: service station attendant

PREREQUISITES AND PRETEST:

1. Be able to change percentages into specific amounts of the whole when the weight or volume of the whole is given. If the weight of a percentage is given, be able to figure out the weight of the whole.
   a. what is 20% of 500 grams?____________________
   b. what is 5% of 250 mls.?______________________
   c. if 60% of the whole is 5, what is the whole.________________
   d. 3% of X = 12, X =_______________________
2. Explain the following terms in your own words.
   a. solute____
   b. solution____
   c. solvent____
3. Be able to accurately use and measure with:
   a. double beam balance
   b. graduated cylinder and measuring cup
4. Remember:
   a. solutions with a solid solute are made up according to percent by weight
   b. solutions with a liquid solute are made up according to percent by volume
   c. 1 ml. of H_2O = 1 gm. of water. (If you make your % weight solutions by the English system you will have to weigh all the water.)

OBJECTIVES:

1. Supplied with the necessary materials, you can make up an approximate amount of a certain solution of a given percent concentration.
2. Given the specifications for the amount and percent concentration of a certain solution, you can describe the procedure for making such a solution.

EQUIPMENT:

solid sodium chloride (approx. 50 gm.)	double beam balance
distilled water (approx. 600 mls.)	paper (to weigh chemical on)

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500 ml. graduated cylinder
1000 ml. beaker
200 ml. beaker
isopropyl alcohol (1/4 cup)
stirring rod
measuring cup

PROCEDURE:

1. Percent by weight is usually used when the solute is a solid. To make approximately 400 mls. of a 10% salt solution, you will use 400 mls. of distilled water. If this 400 mls. or grams of water is to be 90% of the total solution weight, the weight of the whole solution is 444 gms.
2. 100% of the total weight or the amount of salt should be 44 gms. When weighing solids be sure to separately weigh the piece of paper you use to weigh the solid on, to the nearest 0.1 gm. Take care that none of the solid chemical touches the balance. Weigh out 44 gms. of salt on the balance. Be sure to add the weight of the weighing paper to the 44 gms. of salt when adjusting the balance to make your final total weighing.
3. Place your 44 gms. of salt in a beaker and pour in 400 mls. of distilled water (400 gms.) while stirring. This should result in a 10% salt solution by weight.
4. Percent by volume is usually used when the solute is a liquid. To make one cup of a 25% isopropyl alcohol solution you will need 25% of one cup or 1/4 cup of alcohol and the remainder of the cop or 3/4 cups will be distilled water.
5. After making these measurements, pour the two liquids together in a beaker and stir.

DATA AND RESULTS:

1. Give your solutions to your instructor.
2. Can you suggest two simple ways in which you can speed up the dissolving of the solute in the solvent to form a solution?

a.____

b. ____

EVALUATION:

1. How would you go about preparing 500 gms. of a 30% sugar solution?
2. How would you make 300 mls. of a 65% ethylene glycol solution?
3. Optional - How many ml. of a 6% solution of soap and water could you make if you had 50 ml. of liquid soap concentration.

MODULE: Preparation of Solutions of a Given % Concentration

TEACHER SUPPLEMENT

PRETEST:

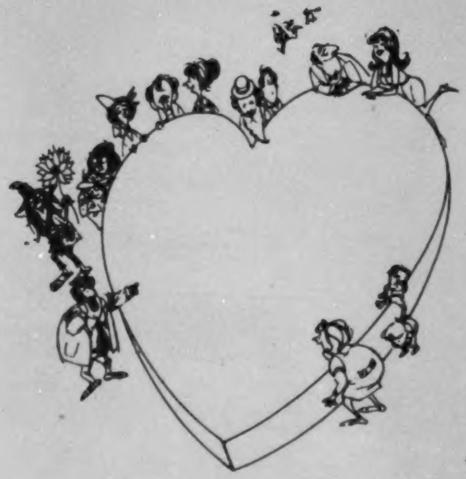
1. a. 100 gms.
   b. 12.5 mls.
   c. $8.\overline{3}$
   d. 400
2. a. solute - a substance which is dissolved.
   b. solution - a liquid containing a dissolved substance.
   c. solvent - a substance capable of dissolving something

DATA AND RESULTS:

2. a. stirring
   b. heating
   c. breaking the solute up into finer parts

EVALUATION:

1. Add 150 gms. of sugar to 350 gms. of distilled water.
2. Mix together 195 mls. of ethylene glycol with 105 mls. of distilled water.
3. (Optional) $833.\overline{3}$ mls.



MODULE: Determining the Rate of Heartbeat

CLUSTER: Medicine and Health

OCCUPATION: doctor
nurse
veterinarian

PREREQUISITE AND PRETEST:

OBJECTIVES:

1. Using a stethoscope you can determine a "patient's rate of heartbeat under varying circumstances.
2. You can suggest why two patients may have different rates of heartbeat under the same conditions.

EQUIPMENT: stethoscope
two willing "patients"
clock or watch with sweep second hand

PROCEDURE:

1. Have your patient seated and relaxed.
2. Put the ear pieces of the stethoscope into your ears and place the sensor over the suspected heart location on the chest or back.
3. After carefully listening and counting the number of heartbeats in 30 seconds, record this rate in beats per minute.
4. Ask your patient to breathe deeply for 30 seconds and again count his heartbeat for the 30 seconds immediately following this activity. Record the rate.
5. Ask your patient to run in place for 1 minutes. Take and then record his rate of heartbeat for the first 30 seconds after the exercise.
6. Take and record the rate of heartbeat for a 30 second period after two minutes have passed since the exercise.
7. Take and record the rate of heartbeat for a 30 second period after four minutes have passed since the exercise.

8. Repeat the whole procedure with a second patient and record your findings.

DATA AND RESULTS:

Be sure to multiply your 30 second counts times 2 to get beats per minute.

Beats per minute	at rest	after deep breathing	immediately after exercise	2 minutes after exercise	4 minutes after exercise
Patient "A"					
Patient "B"					

EVALUATION:

If there is a difference in the rates of heartbeat between your two "patients", suggest why such a difference might exist.

TEACHER SUPPLEMENT

MODULE: Determining the Rate of Heartbeat

MODULE: Sick Dog Simulation

CLUSTER: Medicine and Health

OCCUPATION: veterinarian

OBJECTIVES: Given some symptoms of dogs with minor health problems, you can suggest what is causing the problem and what might be done to remedy the situation.

EQUIPMENT: library

reference books on dogs or pets

PROCEDURE:

1. Consider each systom described concerning a dog. By using what ever resources you have available, suggest what may be causing the problem and what might be done to remedy the situation.
2. List your sources and references.
3. REMEMBER: Your responses are only suggestions and educated guesses to help you become familiar with the role of a veterinarian. Do not practice your ideas on a sick dog which should be getting the proper medical attention of a licensed veterinarian.

DATA AND RESULTS:

PROBLEM	POSSIBLE CAUSE	REMEDY
Diarrhea		
Vomiting		
Skin Abrasions		
Poisoning		
Under Weight		
Running Eyes and Nose		

SOURCES:

EVALUATION:

Turn in your diagnoses and remedies to your instructor.

TEACHER SUPPLEMENT

MODULE: Sick Dog Simulation

MODULE: Making a Plaster Model of Teeth

CLUSTER: Medicine and Health

OCCUPATION: dental assistant
dental technician
dentist

PREREQUISITE AND PRETEST:

OBJECTIVES:

1. Given a mold and other necessary materials, you can make a full-mouth model of the teeth and gums.
2. With the aid of reference materials, you can classify and label each tooth.
3. After carefully inspecting the entire tooth arrangement and alignment, you can make recommendations as to any corrective measures which might be necessary.

EQUIPMENT:

latex mold of upper and lower teeth and gums*
plaster of Paris
water
beaker or cup
spatula or tongue depressor
library

*Your teacher may obtain such a mold (which is no longer useful to a dental professional) from a dentist or dental laboratory.

PROCEDURE:

1. Fill both upper and lower molds with water and then empty into the beaker.
2. Very slowly add plaster of Paris with much stirring. Be sure to break up any lumps. Continue to add plaster of Paris until the mixture has absorbed most of the moisture to form a paste.
3. Fill both halves of the mold which should be moist but free of water pockets.
4. Run your spatula back and forth, up and down in the mold of plaster to be sure all areas have been filled and are free of bubbles.

5. Smooth off any excess plaster from the tops and allow the casts to dry for about 24 hours.
6. Carefully remove the cast models from the molds by turning back the latex sides while gently applying pressure on the outside base of the mold. If your model breaks during removal from the mold you can glue it back together.
7. With the aid of library resource materials, classify and label each tooth with a classification which will distinguish it from all of the other teeth. Mount the models on cardboard and label each tooth, as described in the reference material.

DATA AND RESULTS:

See plaster model which was produced.

EVALUATION:

1. Describe in writing any corrective work you would suggest concerning arrangement and alignment. Use your classification system to refer to the particular teeth in question.
2. Turn your labeled model into your instructor.

TEACHER SUPPLEMENT

MODULE: Making a Plaster Model of Teeth

MODULE: Charting Body Temperatures

CLUSTER: Medicine and Health

OCCUPATION: nurse

ward transcriber

nurses aide

PREREQUISITES:

1. Some elementary experience in graphing would be helpful.
2. Be able to explain the term fever.

OBJECTIVES:

1. Given the data on a patient's temperature over several days, you can:
    a. represent the time and temperature of each measurement taken as a point on a graph.
    b. connect all of these points to give you a "picture" of the relationship between time of day and body temperature.
    c. state how many hours the patient had a fever.
    d. explain the difference between "running a fever" and "have a temperature".
    e. state the time at which the fever broke.
    f. state how time of day affects body temperature

EQUIPMENT: graph paper time and temperature data

PROCEDURE:

Plot the body temperatures vs. the times listed below on a separate sheet of graph paper and connect each dot to form a line.

DATA AND RESULTS:

DATE	TIME	TEMP.
6/15/72	7:00 a.m.	97.8
6/15/72	7:00 p.m.	98.4
6/16/72	7:00 a.m.	97.8
6/16/72	7:00 p.m.	99.0
6/17/72	7:00 a.m.	98.6
6/17/72	7:00 p.m.	101.2
6/18/72	7:00 a.m.	99.8
6/18/72	7:00 p.m.	100.8
6/19/72	7:00 a.m.	99.0
6/19/72	7:00 p.m.	99.2
6/20/72	7:00 a.m.	98.4
6/20/72	7:00 p.m.	98.6
6/21/72	7:00 a.m.	97.8
6/21/72	7:00 p.m.	98.6
6/22/72	7:00 a.m.	97.8
6/22/72	7:00 p.m.	98.6

EVALUATION:

Using only the graph you made, answer each of the following:

1. Approximately how many hours did the patient have a fever?____________________
2. During what date and time span did the fever "break"?____________________
3. Explain the difference between "running a fever" and "having a temperature".____

   ____
4. How does the time of day affect body temperature?____________________

   ____
5. Be sure to turn your graph in with this module.

MODULE: Charting Body Temperatures

TEACHER SUPPLEMENT

PREREQUISITES:

Fever - Body temperature which is above the normal range. In humans, this is above 99.0° F. This is usually caused by disease, more specifically infection.

EVALUATION QUESTIONS:

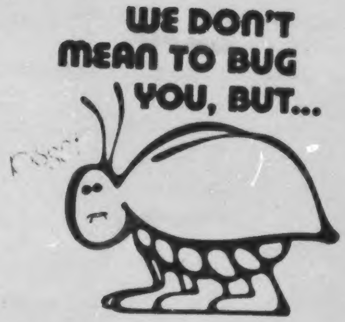
1. Approximately 60 hours (+ or - several hours)
2. Between 7 p.m. on June 19th and 7 a.m. on June 20th.
3. Running a fever means that the body temperature is higher than 98.6 - 99.0°F. Having a temperature is rather meaningless since everything has a temperature.
4. The temperature is usually higher in the latter part of the day by comparison with earlier in the day.

MODULE: Media Preparation and Bacteria for Mold Culture Growth

CLUSTER: Agri-business and Natural Resources

OCCUPATION: crop and soil scientist

dairy technologist



CLUSTER: Medicine and Health

OCCUPATION: medical technologist

CLUSTER: Consumer Foods & Homemaking

OCCUPATION: home economist

CLUSTER: Manufacturing

OCCUPATION: industrial hygienist

OBJECTIVES:

1. Given the necessary materials you can:
    a. prepare bacteria culture media
    b. use this media to test for and culture bacteria present in your environment.
    c. compare and rank the presence of bacteria at various locations in your environment
    d. suggest several factors which encourage the presence and growth of bacteria

EQUIPMENT:

10 sterile glass or disposable Petri dishes

nutrient agar or Knox gelatin with boullion

auto clave or pressure cooker (if possible)

tape

4 - 250 ml. flasks

distilled water

stove, hot plate or Bunsen burner

cotton swabs or "Q Tips"

cotton

PROCEDURE:

1. Weigh out 23 grams of nutrient agar and add this to 1000 ml. of distilled water.

2. Place the container suitable for heating over a heat source and stir the contents gently while it comes to a slow boil.
3. When the agar has completely dissolved in the water, the contents should be poured into 250 ml. flasks and the flasks plugged with cotton.
4. Place the flasks in a pressure cooker and sterilize them under 15 pounds of pressure for 10 minutes. (Be sure to release the pressure very gradually after the sterilizing period or the agar will over-run the flasks.)
5. Allow the agar to cool for 1/2 hour before transferring the contents to Petro dishes. (This can be speeded up by placing the flasks in cold water to drop the temperature of the agar more rapidly.)
6. Place the Petri dishes along the edge of a shelf or desk.
7. Lift the cover of the dish on one edge and pour enough agar into the dish to cover the bottom of the dish.
8. Return the cover immediately to allow the agar in the dish to solidify thoroughly before using.
9. Select various objects around your school, home, etc., which you would like to test for the presence of bacteria.
10. Open the Petri dish and bring the nutrient agar in direct contact with the object to be tested and then immediately put the cover back on the Petri dish. You may use cotton swabs to transfer organisms from an object to the growth medium. This would be necessary in situations where it is impossible to make direct contact of the media with the object.
11. Be sure to keep one dish unexposed as a control.
12. Label each dish with the time and object of innoculation. Record this in the data table.
13. Tape the Petri dishes sheet with cellophane tape and place them upside down in an incubator or some area suggested by your teacher. The dishes should be

allowed to incubate for at least 72 hours before making final observations. Do not at anytime open the dish covers. The cultures may contain pathogenic (disease causing) bacteria.

14. Observe the relative amounts and kinds of colonies in the sealed dishes and record your final observations below.

15. When you are done with the cultures dispose of them in one of the following ways before opening the tape seal:
    a. if the dishes are glass and reusable, resterilize in pressure cooker or auto-clave before disposing of the contents and washing the dishes.
    b. if plastic disposable dishes are used, incinerate the cultures without opening them.

DATA AND RESULTS: (When ranking use 1 as the greatest)

CULTURE	DATE & TIME	OBJECT SOURCE	RANK RELATIVE AMOUNTS	RANK AS TO NUMBERS OF KINDS
#1				
#2				
#3				
#4				
#5				
#6				
#7				
#8				
#9				

EVALUATION:

1. What kind of objects or locations tend to harbor bacteria and molds?

2. What conditions tend to encourage bacterial and mold growth?

ADDITIONAL ACTIVITIES:

You may want to determine the effect of (a) temperature, (b) antibiotics, (c) antiseptics, (d) toothpaste or mouthwash, etc., on bacterial growth.

Resource: Minnesota Department of Education, Laboratory Investigations in the Life Sciences for the Junior High School, 6-4.

MODULE: Media Preparation and Bacteria for Mold Culture Growth

TEACHER SUPPLEMENT

EVALUATION:

1. Students looking for suggestions might be encouraged to collect organisms from door knobs, drinking fountain spouts and handles, shoe scrapings, scrapings of the teeth, hair, a comb, locker room floor, books, the air (especially between classes, etc.)
2. a. warmth
   b. moisture
   c. protection
   d. food supply

MODULE: Preparation of Blood Smears

CLUSTER: Medicine & Health

OCCUPATION: medical technologist

PREREQUISITES:

Be able to use the microscope

OBJECTIVES:

1. Given the necessary lab equipment, you can make a blood smear of your own blood.
2. Using the blood smear you prepared, you can:
   a. make a drawing of as many different types of blood cells as you observe.
   b. estimate the ratio of red blood cells to white blood cells.

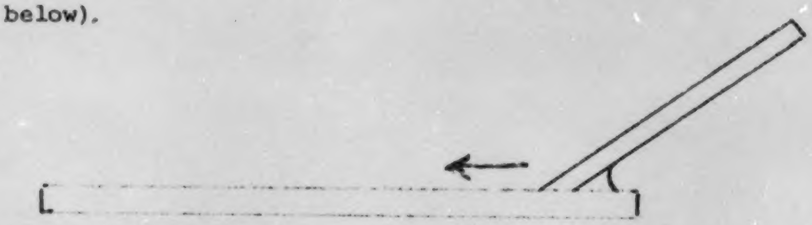
EQUIPMENT:

1 drop of your blood
sterile disposable blood lancet
alcohol
cotton
parent consent slip for blood test (if required)
microscope

clean slide
Wright's blood stain
Petri dish
tongs or tweezers
distilled water
colored pencils

PROCEDURE:

1. Clean your finger with alcohol on cotton.
2. When the alcohol dries, puncture the skin with a sterile, disposable lancet and place a drop of blood on one end of a clean slide.
3. Clean the finger with alcohol again. If bleeding does not stop, apply pressure with sterile cotton.
4. Place a second slide with one end at a 30° angle, on the first slide (see figure below).



5. Bring the upper slide up to the drop of blood until the blood spreads along the narrow end of the upper slide evenly.
6. Push the upper slide rapidly toward the opposite end of the bottom (level) slide to form a thin film. The greater the angle of the top slide, the thicker the film that is formed.
7. Allow the slide to air dry.
8. Place the slide in a Petri dish and cover the dry blood film completely with Wright's stain.
9. After 3 minutes, add distilled water drop by drop until a metallic, greenish scum forms on the surface of the slide.
10. Continue to add water until you have doubled the amount of liquid. Let it stand for 3 minutes.
11. Remove from the stain solution and place the slides in pure distilled water for 3 minutes.
12. Wash the slide with water continuously, until it is lavender pink.
13. Stand the slides on edge to dry or blot with filter paper.
14. Observe under the microscope. If slide is too dark, decolorize by returning slides to distilled water.

DATA, RESULTS AND EVALUATION:

1. Make a colored drawing of each different type of blood cell you observe.
2. By counting the number of red cells and white cells in 1/4 of your field of view, estimate the ratio of red blood cells to white blood cells. (This may vary greatly depending on the sampling)
3. Turn in your blood smear slide with this lab activity.
4. Optional - What is the function of red blood cells? White blood cells?

5. Optional - Under what conditions would the ratio or red cells to white cells change?

RESOURCE: Morholt, Brandwein, Joseph, A Source Book for Biological Sciences, Harcourt, Brace & World, 1961, p. 118

TEACHER SUPPLEMENT

MODULE: Preparation of Blood Smears

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MODULE: Determining Blood Pressure

CLUSTER: Medicine and Health

OCCUPATION: doctor
nurse

PREREQUISITES AND PRETEST:

1. Be able to hear heartbeat through a stethoscope.
2. Know the meaning of systolic and diastolic.
3. List five factors which may influence blood pressure.

1.______________________________

2.______________________________

3.______________________________

4.______________________________

5.______________________________

OBJECTIVE:

1. Given the necessary equipment you can take the blood pressure of two of your classmates. The reading will be in near agreement with the reading for the same patient, when read by another classmate or the instructor.

EQUIPMENT: sphygnomanometer stethescope
2 willing "patients"

PROCEDURE:

1. Have your patient seated with the left arm relaxed and supported in a table.
2. Wrap and tie the pressure cuff around the upper left arm.
3. Position the stethescope an inch below the arm bend onthe inside of the forearm. The correct spot can be detected by feeling for pusation in that area with three fingers.
4. Inflate the cuff until the pulsation originally heard through the stethescope is no longer heard.
5. Allow the air to gradually escape by loosening the bulb valve, until pulsation is heard once again. At this point read the systolic pressure on the manometer.

6. Continue to deflate the cuff and listen carefully. The point at which the loud thumping changes to a soft sound is the diastolic pressure. The pressure of the manometer should quickly be read.

7. Release all of the air. It is a good idea to repeat the procedure immediately as a check on the first trial.

8. Remove the cuff and fold it up.

		Patient A		Patient B	
		systolic	diastolic	systolic	diastolic
Your results	trial				
	1st				
	2nd				
Class-mate's or in-structor's	1st				
	2nd				

EVALUATION:

1. Consider how close your readings were to chose of your classmate's or instructor.

2. If there was a difference of 10 mm.or more in the blood pressure readings in your two "patients" give several possible explanations for the difference.

RESOURCE: Price, Alice L., The Art, Science and Spirit of Nursing,
W. B. Saunders Co., Philadelphia, 1954, pp. 443-9.

TEACHER SUPPLEMENT

MODULE: Determining Blood Pressure

228 A

MODULE: Toothpastes, Powders and Stains

CLUSTER: Medicine and Health

OCCUPATION: dental hygenist
dentist

PREREQUISITES AND PRETEST:

OBJECTIVES:

1. Given several stained samples, you can test and compare the whitening power of several tooth cleaning products.
2. Using any reference materials available, you can list four common ingredients of toothpastes and powders and suggest what purpose they serve when used on the teeth.

EQUIPMENT:
3 brands of toothpaste (labelled with cost)
at least one brand of tooth powder (labelled with cost)
toothbrush
water
baking soda ($NaHCO_3$), (labelled with cost)
grape juice concentrate
concentrated coffee
concentrated tea
(optional) nicotine and tar extract from smoking machine
white painted board (of an area at least 25 sq. in.)

PROCEDURE:

I. If you are using five tooth cleaning agents, divide your white board into seven equal parts.
2. In each **area** place one drop each of three of the various staining materials available. Be careful so the stains do not intermix.
3. In the first section, scour each stain with one brand of toothpaste and rinse. Record your observations.

4. Do the same in each of four other sections with each of the other toothpastes, the tooth powder, and the sodium bicarbonate.
5. In the sixth section, scour with just the wet toothbrush and rinse the section.
6. In the seventh section, which you will use as your control, simply rinse the staining material off without any brush action at all.
7. Complete the data chart below. Be sure to include the brand names of toothpastes and powders in the first vertical column and the particular stains you used in the first horizontal column. Describe the action of each cleaner upon the stain as good, fair, poor or no effect.

DATA AND RESULTS:

	Stains Used		
CLEANING AGENT:			
______ toothpaste			
______ toothpaste			
______ toothpaste			
______ toothpowder			
Baking Soda			
Water only			
Control			

EVALUATION:

1. Which of the cleaning agents was most effective for over-all stain removing?

2. Using reference materials (tooth product formulas in library source books, tooth cleaner labels, information from Food and Drug Administration, interviews with dental personnel, etc.) list three common ingredients of toothpastes or powders and suggest what purpose they serve when used on the teeth.

3. Other than removing stains and whitening your teeth, what other main function do toothpastes and powders serve.

MODULE: Toothpastes, Powders and Stains

TEACHER SUPPLEMENT

ADDITIONAL ACTIVITIES:

1. Conduct an experiment in which you can test the ability of various toothpastes to inhibit bacterial growth.
2. Conduct an experiment using extracted and discarded teeth from your dentist to determine the affects of "Coke", butterscotch syrup, milk, etc. on the teeth.
3. Common ingredients may be:
   - powdered calcium carbonate
   - soap
   - flavoring (oil of peppermint, wintergreen, etc.)
   - stannous fluoride (in some types)
4. Other than whitening, the other main function of toothpaste and powders are to kill decay causing bacteria. Some other products reinforce the mineral content through fluoridation. Most are designed to freshen the breath.

MODULE: Consumer Poll

CLUSTER: Marketing & Distribution

OCCUPATION: marketing research
purchasing agent
wholesale trade people

PRETEST:

1. Determine 20% of each of the following numbers (to the nearest whole number).

a. 100____________ c. 40____________

b. 239____________ d. 25____________

OBJECTIVE:

The student will be able to conduct a consumer poll that will help determine the market for a product.

EQUIPMENT: pencil class list

paper container for slips of paper

PROCEDURE:

One way a manufacturer can determine the need for an item is to conduct a consumer research poll.

You have been assigned to determine the need for a pencil dispensing machine in your school. You will have to come up with an estimate as to the number of pencils that might be sold and at what price. A questionnaire has been written and you must use it to interview about 20% of the students in your class.

1. Choose randomly the students to be interviewed by the following method:
   a. get a class list from your teacher and number each name.
   b. cut enough small squares of paper (approx. 1" x 1") so that you have one for each person in class.
   c. number the squares of paper the same way that you numbered each of the names.
   d. place the numbered pieces of paper in a container and, without looking, draw a 20% sample.

    e. as you draw each number underline the corresponding name on your list

    f. the names that you have underlined will be the names of the people that you will interview.

2. Using the questionnaire printed at the end of this module interview the students that were chosen.

3. Enter the data collected on the following data table:

DATA AND RESULTS:

QUESTION NUMBER

NUMBER OF STUDENTS ANSWERING WITH LETTER:

1. (a)__________ (b)__________ (c)__________ (d)__________

2. (a)__________ (b)__________ (c)__________ (d)__________

3. (a)__________ (b)__________ (c)__________ (d)__________

EVALUATION:

1. From this data do you think that the students in your class would make use of a pencil machine?
2. How many pencils do you think you could sell toyour class in one week?
3. From your sample, how many pencils do you predict could be sold in your school during a one week period?

FURTHER ACTIVITY:

You took your sample from a rather small population of people. Most surveys are concerned with populations that are much larger. With this kind of tool, the larger the population, the more accurate the survey. Do you think you could devise a survey method that would work for the entire population of your school?

QUESTIONNAIRE FOR DETERMINING THE MARKET FOR PENCIL DISPENSING MACHINES

1. How many times during a week do you find yourself without a pencil when you need one?

    a. none
    b. 1 - 5
    c. 6 - 10
    d. 11 or more

2. What do you usually do when you need a pencil and you don't have one?

a. nothing

b. take one

c. borrow one from a student or teacher

d. buy one from a student or teacher

3. If there was a pencil dispensing machine that was in a convenient location, would you buy a pencil from it whenever you needed one?

a. no, I would never spend money on a pencil, I would get a pencil another way

b. no, I always have a pencil with me

c. yes, if the cost was 5¢ or less

d. yes, even if the cost was as much as 10¢

MODULE: Consumer Poll

TEACHER SUPPLEMENT

PRETEST:

1. 20

2. 48

3. 8

4. 5

WATCH IT GROW!

MODULE: Yeast Culture I - Identification of Gas from Rising Dough

CLUSTER: Marketing & Distribution

OCCUPATION: baker

CLUSTER: Consumer, Foods & Homemaking

OCCUPATION: chef

technologist - food

home economist

PREREQUISITE: Find out how lime water is used in the identification of gas.

OBJECTIVES:

1. You can explain what causes bread to rise.
2. Given the necessary materials, you can make some rising dough and identify the gas it produces.
3. You can suggest at least 2 factors which affect yeast growth.

EQUIPMENT:

flour
sugar
dry yeast (baking)
water
spoon or other stirring utensil
measuring cup
set of measuring spoons

limewater (alternate indicator Bromethymal Blue)
glass tube
2 gas collecting bottles
2 - one hole stoppers for these bottles

PROCEDURE:

One of the most important ingredients in baking is yeast. A good baker must have a good understanding of the functioning of yeast.

1. Mix well one cup of flour, one tablespoon of sugar, 1/4 package of dry baking yeast, 1/2 cup of water.
2. Place this dough mixture in one bottle.
3. Add lime water to the second bottle so that it is approximately half full.

4. Assemble the stoppers, bottles and glass tubing as is shown in the following figure:

5. Place the apparatus in a warm place and allow the dough in the jar to raise to at least twice its size.

6. Once the dough has risen, remove the stopper and poke holes in the dough. Quickly seal it again.

7. Observe what happens to the lime water.

DATA AND RESULTS:

1. Describe what happened to the limewater______________________________

____

2. What gas does the yeast give off?______________________________

EVALUATION:

1. Suggest at least two factors which might increase or decrease the activity of yeast?______________________________

2. Why does bread rise?______________________________

ALTERNATE METHOD: Bromethymal Blue will turn from blue to green to yellow as the CO_2 becomes dissolved in the water.

MODULE: Yeast Culture I - Identification of Gas from Rising Dough

TEACHER SUPPLEMENT

DATA AND RESULTS:

1. It becomes cloudy.
2. Carbon dioxide.

EVALUATION: The amount of sugar, the temperature, the amount of moisture.

MODULE: Yeast Culture II - Effect of Temperature on the Activity of Yeast

CLUSTER: Marketing & Distribution

OCCUPATION: baker

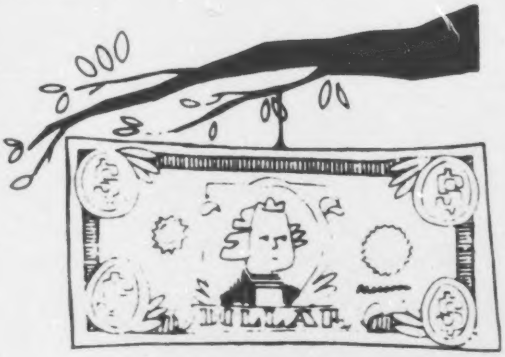
bakery worker

chef

CLUSTER: Consumer Foods & Homemaking

OCCUPATION: technologist - food

home economist


WATCH IT GROW!

OBJECTIVES:

Given the needed materials, you will be able to demonstrate the effect of temperature on the activity of yeast.

EQUIPMENT:

flour

sugar

yeast - bakers

water

measuring cup

3 - 600 ml. beakers or pint jars

3 thermometers °C student type

ruler

spoon or other utensil for stirring

set of measuring spoons

warm water bath, radiator or incubator

refrigerator or cool window ledge

PROCEDURE:

1. For each beaker, using the sppon, mix one cup of flour, one tablespoon of sugar, 1/4 package of commercial yeast, 1/2 cup of water.
2. Using one of the thermometers, find three locations that have different temperatures. (Try for room temp, 5-10° C below room temperature and 5-10° above room temp)
3. Place each of the beakers with the dough mixture in one of the areas that you have selected. Place one of the thermometers next to each of the beakers.

4. Using the ruler, measure the height of the dough in each of the beakers once every 15 minutes. Record this data in the data table along with the temperature reading

DATA AND RESULTS:

DATA TABLE: TEMPERATURE AND HEIGHT OF DOUGH

BEAKER	OBSERVATION	1	2	3	
1	TEMP				
	HEIGHT				
2	TEMP				
	HEIGHT				
3	TEMP				
	HEIGHT				

EVALUATION:

1. At which temperature did the dough rise the fastest?__________________________

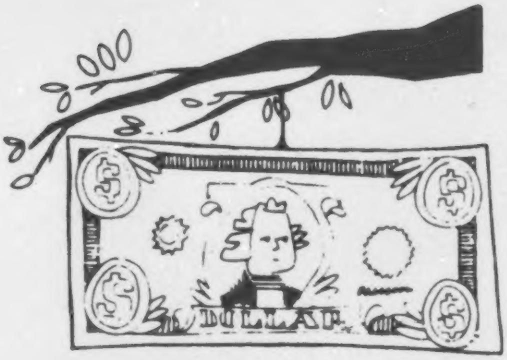
   Slowest?_________________

2. At what temperature do you think you should let bread raise?__________________

TEACHER SUPPLEMENT

MODULE: Yeast Culture II - Effect of Temperature on the Activity of Yeast

MODULE: Yeast Culture III - Effect of the Amount of Sugar on the Activity of Yeast



WATCH IT GROW!

CLUSTER: Marketing & Distribution

OCCUPATION: baker

baker worker

CLUSTER: Consumer, Foods & Homemaking

OCCUPATION: chef

technologist - food

home economist

OBJECTIVES: Given the needed materials, you will be able to determine the effect of various amounts of sugar on the activity of yeast.

EQUIPMENT:

flour
sugar
yeast - baking
water

4 - 600 ml. beakers
ruler (metric)
spoon or stirring utensil
measuring cup
set of measuring spoons

PROCEDURE:

1. Number the beakers one through four.
2. For beaker #1 mix one cup of flour, two tablespoons of sugar, 1/4 package of baking yeast, 1/2 cup of water.
3. Do the same for the remaining three beakers except:
   a. use one tablespoon of sugar for #2. This one will be the control.
   b. use 1/2 tablespoon of sugar for #3.
   c. do not use any sugar for #4.
4. Place the beakers in a warm place and using a ruler measure the height of the dough once every 15 minutes. Record your measurements on the data table.

DATA AND RESULTS:

DATA TABLE - HEIGHT RISING OF DOUGH VS THE TIME

Beaker	Contents	Height after 15 min.	30 min.	45 min.
1.	2 tbsp. of sugar			
2.	1 tbsp. of sugar			
3.	1/2 tbsp. of sugar			
4.	no sugar			

EVALUATION:

1. Did changing the amount of sugar in the dough affect the raising of the dough?____________If so, why did this occur?______________________________
2. Why was the use of one tablespoon of sugar considered the control for the experiment? (Check the two previous yeast activities).
3. What was the variable ingredient in this experiment?

MODULE: Yeast Culture III - Effect of the Amount of Sugar on the Activity of Yeast

TEACHER SUPPLEMENT

ANSWERS:

EVALUATION:

2. One tablespoon of sugar is the proportion of sugar used in most bread recipes.
3. Sugar

MODULE: Retail Sales - Purchasing

CLUSTER: Marketing & Distribution

OCCUPATION: druggist
retail store people
wholesale trade people
clerk - stock
manufacturers salesman

PREREQUISITES AND PRETEST:

OBJECTIVES: You can predict seasonal changes in sales and the time and items that should go on an end of season sale.

EQUIPMENT: pencil

PROCEDURE:

1. You are responsible for the ordering for a "dime" store. To help you with your ordering you have divided the year into four selling seasons. These seasons are:

Summer -	15 May - 6 August
Fall -	7 Aug - 25 November
Winter -	26 Nov - 28 February
Spring -	1 Mar - 14 May

2. Following are the major catagories of merchandise that your store handles.

Clothing - socks, underwear, swim wear and other small items.
Cosmetics - health and beauty aids
Toys - all kinds
Games -
Candy -
Stationery - Office and school supplies
Soda Fountain - service ice cream, pop and sandwiches
Greeting cards -
Garden supplies and equipment

3. In order to get the merchandise you need for each of the seasons, your suppliers recommend that you place your big orders at least two months before the selling season starts.

SELLING SEASON	RECOMMENDED ORDER DATE
Summer	15 March
Fall	7 June
Winter	26 September
Spring	1 January

DATA AND RESULTS:

1. What items would you order a lot of on each of these dates?
    - a. 15 March
    - b. 7 June
    - c. 26 September
    - d. 1 January

2. What would be the best time for your seasonal close out sales? What items would you close out in each of these sales?

Close out sales number 1: Date:______________________

Items on sale:

Close out sales number 3: Date:______________________

Items on sale:

Close out sales number 4: Date:______________________

Items on sale:

EVALUATION:

1. What factors help determine what items you keep and store away for next year or sell on a close out sale.

2. How can you protect yourself against missed or late shipments from manufacturers?

MODULE: Retail Sales - Purchasing

TEACHER SUPPLEMENT

ANSWERS:

DATA AND RESULTS:

1. a. Father's Day cards, swim suits, sun tan lotion (cosmetics), shaving cosmetics for Father's Day.
   b. School supplies, children's shoes and clothing (for school), Thanksgiving cards.
   c. Toys, games, cosmetics, gift boxes of stationary and other stationery gift ideas, gift items of clothing, Christmas cards and decorations.
   d. Mother's Day cards, gift candy, and cosmetics for Mother's Day, garden supplies and equipment, Easter cards, Easter candy, baskets and decorations.
2. Close out the seasonal items at the end of the season. This is when there is still some demand for the items. Sales generally should last 2 or 3 days up to a week.

EVALUATION:

1. You would close out those items that would either spoil or appear to be "dated" during the next year's season or that would be impractical to store. (i.e. candy would spoil, religious Christmas cards might be "in" for this Christmas season where as they might not be during the next Christmas season, and most stores don't have room to store large bulky items)
2. Get your order in early.

MODULE: Matching Hair Styles to Facial Shapes

CLUSTER: Personal Services

OCCUPATION: beauty operator

CLUSTER: Fine Arts & Humanities

OCCUPATION: actor, actress

CLUSTER: Consumer, Foods & Homemaking

OCCUPATION: model

CLUSTER: Transportation

OCCUPATION: stewardess

PREREQUISITES:

OBJECTIVES:

1. Given a picture of a person's face you can:
   a. identify those features you would like to be emphasized
   b. identify those features you would like to be minimized
   c. identify ways in which hair styles could do this
2. Given several different face shapes you can sketch hair styles which are correct for them.

EQUIPMENT: drawing pencil and eraser

PROCEDURE AND DATA:

PART A. Facial Types and Beautifying Hair Styles

ARTISTRY IN HAIRSTYLING

The principles of modern hairstyling and make-up are guides to the cosmetologist in selecting what is most appropriate in achieving a beautiful facial appearance. Best results are obtained when each facial type is analyzed for its own merits and defects.

Each type of face demands a distinctive coiffure that is rightly proportioned, balanced of line, and correctly frames the face. Every accomplished

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cosmetologist possesses a sense of balance and harmony in visualizing and creating coiffures. The essentials of an artistic and suitable hairsyle must, therefore, be based upon the following general characteristics:

1. Shape of the entire head:
    a) Front view
    b) Profile (side view)
2. Characteristics in features:
    a) Perfect as well as imperfect features
    b) Defects or blemishes
3. Body structure, posture, and poise.

1. Read through the information on facial types on the next three pages.

FACIAL TYPES

The facial type of each patron is predetermined by the position and prominence of the facial bones. There are seven facial patterns, viz, oval, round, square, oblong, pear-shape, heart-shape and diamond.

To recognize each facial type and be able to give correct advice, the cosmetologist should be acquainted with the outstanding characteristics of each.

OVAL FACIAL TYPE

The **oval type** is generally accepted as the perfect face. The contours and proportions of the oval face form the basis for modifying all other facial types.

Facial Contour: The oval face is about one and a half times longer than its width across the brow; the forehead is slightly wider than the chin.

Aim: To maintain the oval contour.

Any style can be worn as there are no features to minimize.

ROUND FACIAL TYPE

Facial Contour: Round hairline and round chin line.

Aim: To create the illusion of length to the face.

Arranging the hair high on top of the head, and leaving the ears exposed or the hair dressed flat over the ears, will help to minimize the roundness of the face.

SQUARE FACIAL TYPE

Facial Contour: Straight hairline and square jawline.

Aim: To create the illusion of length and offset the squareness of the features.

The problems of the square facial type are similar to those of the round. Hair lifted at sides but higher on one side will add to the apparent length of the face.

PEAR-SHAPE FACIAL TYPE

Facial Contour: Narrow forehead, wide jawline and chin line.

Aim: To create the illusion of width in the forehead and length in the face.

Keeping the hair dressed fairly full and high above the ears, and leaving the forehead exposed will add to the

OBLONG FACIAL TYPE

Facial Contour: Long narrow face with hollow cheeks.

Aim: To create the illusion of shortness and width to the face.

The hair should be styled fairly close to the top of the head with a fringe of curls or bangs. Combined with fullness at the sides, it will help to reduce the apparent length of the face.

DIAMOND FACIAL TYPE

Facial Contour: Narrow forehead, extreme width through the cheekbones, and narrow chin.

Aim: To reduce the width across the cheekbone line.

Increasing the fullness across the forehead and at the jawline, while keeping the hair close to the head at the cheekbone line will help to create the illusion of ovalness to the face.

HEART-SHAPE FACIAL TYPE

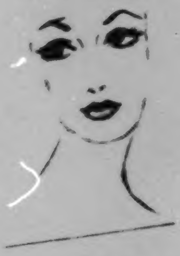
Facial Contour: Wide forehead and narrow chin line.

Aim: To decrease the width of the forehead and increase the width in the lower part of the face.

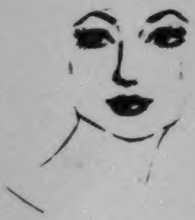
To reduce width of forehead, a hairstyle slanted to one side is recommended. Add width and softness at the jawline.

2. Draw appropriate hair styles on each of the face outlines in Data Section A sketched. Beneath each face outline describe the feature(s) your hair style accented or minimized. Consult beauty magazines and women's magazines for suggestions if you wish.

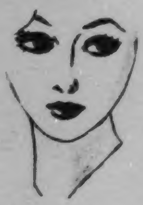
Long Shape



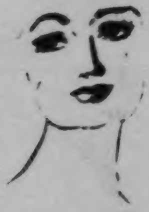
Pear Shape



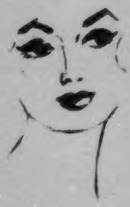
Heart Shape



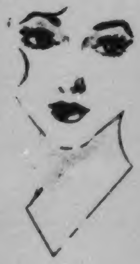
Square Shape



Round Shape



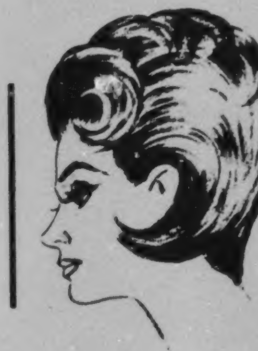
Diamond Shape



PART B. Facial Profiles and Beautifying Hair Styles

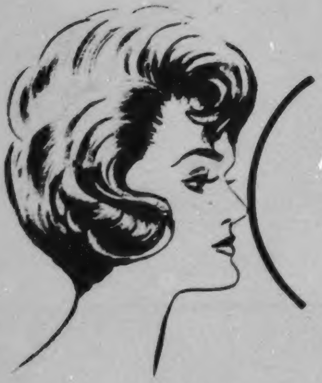
1. Read through the following information on profiles.

PROFILES



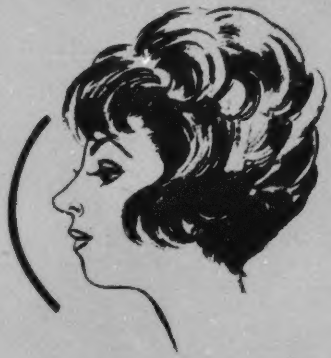
STRAIGHT

Usually, all hairstyles are becoming to the straight or normal profile.



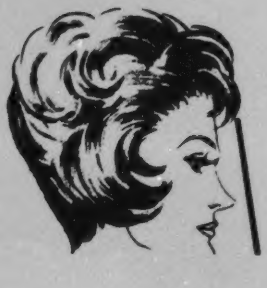
CONCAVE PROMINENT CHIN

Requires close hair arrangement or bangs over the forehead to minimize the bulginess of the forehead. The hair at the sides and nape of the neck should be dressed in small, soft curls or waves to soften the features.



CONVEX

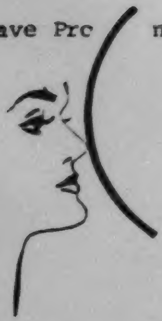
Curls or bangs should be placed forward on the forehead to conceal receding forehead and irregular hairlines. The hair at the sides and nape of the neck should be dressed close to the head to give it perfect balance.



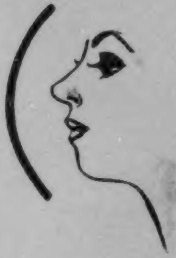
LOW FOREHEAD, PROTRUDING CHIN

To create the illusion of height to a low forehead and length to the face, the hair should be dressed high on the top of the head with curls or bangs

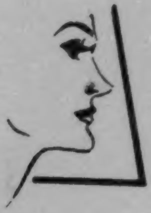
Concave Prc nt Chin



Convex



Low Forehead,
Protruding Chin



EVALUATIONS:

1. Show your drawings to your teacher.
2. Bring five pictures of women to class. You may cut these pictures out of your magazines or newspapers. Write a few sentences about each:
   a. describing their facial shape
   b. commenting on their hair style and its appropriateness to their facial shape.
3. Can you assume that features you wish to minimize would be thought unattractive by everyone? Explain
4. Analyze your own face and briefly describe the features you wish to emphasize and minimize. What hair style(s) would help you do this?
5. What facial shapes would be most complimented by an Afro?

MODULE: Matching Hair Styles to Facial Shapes

TEACHER SUPPLEMENT

SAMPLE RESULTS:

See the module diagrams

ANSWERS TO QUESTIONS:

1. Check drawings to see if they generally did what was suggested in the paragraph. i.e. Square Facial Type: Did they create an illusion of height by sweeping hair upward or having it fall long near the shoulders?
2. Students should classify faces by the sex shapes or three profiles. They then should state whether the hair style is attractive and why or why not.
3. No. Beauty seems to be a cultural thing with each culture gaining some individual identity through appearance. "Beauty is in the eye of the beholder."
4. This depends on the individual.
5. Long faces would look best with the bushy "Afro" hair style.

SUPPLEMENTARY INFORMATION:

1. Students may study makeup in the same manner. The reference book by C. V. Kibbe is good.
2. If several students are doing this activity you might plan a hair styling competition. The home economics department may join in the activity.
3. A beauticians club or quest may be formed if sufficient interest is shown. Perhaps local operators would visit and give demonstrations.

MODULE: Dandruff Information, Observation, and Control

CLUSTER: Personal Services

OCCUPATION: beauty operator

dermatologist

PREREQUISITES AND PRETEST: Ability to use a microscope

OBJECTIVES:

1. You can define dandruff and state:
    a. how it is similar to soda cracker crumbs
    b. how it is different from soda cracker crumbs
2. Given people who have dandruff in varying amounts, you can:
    a. identify some causes of dandruff
    b. suggest a product and/or action which may help the condition
    c. decide when medical help may be necessary

EQUIPMENT:

several different brands of "dandruff shampoo" (may be furnished by student testers)

reference sources on skin, scalp, and hair

microscope

one microscope slide

soda crackers

PROCEDURE:

1. Write a one to two page paper answering the following questions, plus any you may think of. Use written reference material and interviews with medical personnel if possible.
    a. what is dandruff?
    b. what causes dandruff? (list several)
    c. is having dandruff normal? If so, how much?
    d. how can dandruff be treated?

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e. Is it possible to completely eliminate dandruff? Explain.

2. Dandruff Study

   a. Find several people who have varying amounts of dandruff. Be tactful because having dandruff embarrasses some people. Ask your volunteers to shampoo their hair two or three times a week for two weeks as follows:

      left side of their head - shampoo with a "dandruff" shampoo

      right side of their head - shampoo with normal shampoo

      Reproduce enough copies of the questionnaire in the DATA and RESULTS section so that each volunteer has one. Ask them to complete it and return it to you at the end of the two week period.

   b. Place several dandruff flakes on a microscope slide and observe them carefully first with your unaided eyes, then under a microscope. Decide, with your teacher's help, if dandruff flakes are skin cells. This may require staining. Draw what you see in DATA section. Place a drop of diluted dandruff shampoo solution on the flakes and observe what happens for about five minutes using the microscope. Sketch this on the appropriate slide in the DATA section. Substitute fine cracker crumbs for the dandruff flakes and repeat procedure b.

DATA AND RESULTS:

a. Questionnaire: Dendruff Shampoo Comparisons

Dandruff Shampoo Brand________________Normal Shampoo Brand____________________

Condition	Much Improved	Some Improved	Not Improved	Made Worse	Much Improved	Some Improved	Not Improved	Made Worse
Itching								
Amount of flakes on scalp								
Amount of flakes on shoulders								
Hair luster								
Hair managability								
Time between needed shampoos								

b. Sketches

unaided eye

dandruff crumbs

microscopic view

dandruff crumbs

microscopic view

dandruff crumbs with shampoo

EVALUATION:

1. Look at the labels of various "dandruff" and normal shampoos.

   a. What ingredient(s), if any, do the brands of dandruff shampoo have in common?

   b. What ingredients, if any, do both dandruff and normal shampoos share?

NOTE: You can get information from the Food and Drug Administration and the manufacturers on the shampoo ingredients.

2. Does dandruff shampoo dissolve, or in som e observable way, affect dandruff flakes?

3. Whas is a dandruff shampoo designed to do that a normal shampoo does not do?

4. Are dandruff flakes skin cells? Explain how you know.

5. How are cracker crumbs:

    a. similar to dandruff?

    b. different from dandruff?

6. Tabulate the results of your questionnaires and identify which shampoo give the best results ______________________________

Optional:

How is the amount of dandruff affected by the acidity or basicity of the scalp?

How might acid or base shampoo reduce scalp flaking?

MODULE: Dandruff Information, Observation and Control

TEACHER SUPPLEMENT

SAMPLE DATA:

The students will find that dandruff is scalp skin which has flaked off as as result of normal cell renewal. They may be able to see cell nuclei if the cells are stained, otherwise the cracker crumbs and dandruff flakes will be quite similar. The high starch content of the crackers should turn dark purple in iodine solution also.

Dandruff shampoo will have little or no effect on the flakes themselves.

ANSWERS TO QUESTIONS:

1. a. Dandruff shampoos often contain: hexaclorophene, salicylic acid, and sulfur
   b. All shampoos share a soap, detergent, or wetting agent like phosphate or carbonate, and usually a little oil and attractive scent.
2. No - or very slightly.
3. The chemicals in "dandruff" shampoo are designed to kill microorganisms which cause excessive flaking, itching, and redness. Seborrheic Dermatitis is an example. Some are also intended to neutralize the acidity or basicity of the scalp. Basic shampoos or soaps tend to dry the scalp and increase flaking.
4. Dandruff is skin cells. They may be identified by staining the nuclei with iodine solution and/or researching reference sources.
5. a. Cracker crumbs are similar in color, texture, shape, weight, unaided eye appearance.
   b. Cracker crumbs are different in microscopic view, iodine reaction.
6. ---

SUPPLEMENTARY INFORMATION:

Audity and basicity may be checked using litmus or pH paper.

MODULE: Testing Hair Coloring Agents

CLUSTER: Personal Services

OCCUPATION: barber
beauty operator
cosmetologist

PREREQUISITES:

1. Be able to read and carefully follow the directions and precautions supplied with commercial hair coloring products.
2. Obtain the needed hair samples from a barber or beauty shop. Under no condition are you to test these dyes on hair still attached to someone's head.
3. Explain what a variable is and what a constant is in an experiment.

OBJECTIVES:

1. Supplied with the necessary lab and commercial hair coloring materials. you can:
   a. color 5 hair samples taken from the same subject with 5 different coloring products.
   b. color hair samples of 4 different colors from different subjects with the same coloring product.
2. By observing the hair samples you colored, you can evaluate the products on the basis of stated qualities.
3. By examining the data from an experiment, you can identify the constants, the variables.

EQUIPMENT: 6 hair samples from the subject
2 different blond hair dyes
1 bottle 3% hydrogen peroxide
6 - 250 ml. beakers
1 sample of the following - each from a different subject
natural blond

natural grey

natural black

peroxided blond

1 red hair dye

rubber or plastic gloves

water for rinsing

microscope

DIRECTIONS:

A. 1. Using the 6 samples all from the same subject, treat them each according to bottle directions with one of the following:

a.	"Brand X" blond rinse	d.	"Brand N" blond dye
b.	"Brand Y" blond rinse	e.	3% hydrogen peroxide
c.	"Brand M" blond dye	f.	control - no treatment

2. Record your observations on Table 1 at the end of the module.

3. Fill in an additional quality for comparison in the first column, the last blank.

B. 1. Using a sample of natural blond, natural grey, natural black, and peroxided blond hair, treat them equally according to bottle directions with red hair dye.

2. Record your observations on Table 2 at the end of the module.

3. Fill in an additional quality for comparison in the first column, the last blank.

DATA AND RESULTS:

1. See Tables 1 and 2 at the end of the module for observations.

2. Using Table I:

   a. what colored sample looks most natural?________________________________

   b. what colored sample seems most unchanged when compared to the control under microscopic examination?________________________________

   c. which treatment was easiest to use?________________________________

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3. Using Table 2:

a. which hair color tested appears most natural?____________________

b. can your classmate identify the condition of any of the samples?________

c. what difference, if any, is there in the effect of red hair dye on natural blond compared to peroxided blond hair?____________________

____

EVALUATION: (Use tables 1 and 2 for reference when answering)

1. If you were to recommend a blond hair coloring product, which one would you suggest and why?__________________________________

____

2. According to Table 1:

a. name one constant____

b. name the variable____

3. According to Table 2:

a. name one constant____

b. name the variable____

TABLE I

	"Brand X" blond rinse	"Brand Y" blond rinse	"Brand M" blond dye	"Brand N" blond dye	3% hydrogen per.	Control
Microscopic Appearance						
Trueness of color compared to label						
General Appearance						
Colorfastness						
Cost per Treatment						
Ease of Use						

TABLE 2

	Natural Blond	Natural Grey	Natural Black	Peroxided Blond
Microscopic Appearance				
General Appearance				
Trueness of Color to Label				
Colorfastness				

MODULE: Testing Hair Coloring Agents

TEACHER SUPPLEMENT

PREREQUISITES:

Constant - A condition which stays the same throughout the entire experiment.

Variable - A condition which is different for each part of the experiment. It is usually the condition you are changing to see its effect on what you are testing.

EVALUATION:

2. a. constant - use of a blond coloring agent, the kind of hair used - the tests you run on it.
   b. variable - the kind of coloring agent
3. a. constant - the red hair dye, the tests you run on them.
   b. variable - the kind of hair tested

MODULE: Optical Illusions Using Make Up

CLUSTER: Fine Arts and Homemaking

OCCUPATION: actor - actress

CLUSTER: Consumer, Foods and Homemaking

OCCUPATION: model

CLUSTER: Personal Services

OCCUPATION: beauty operator
cosmotologist

CLUSTER: Transportation

OCCUPATION: airline stewardess

PREREQUISITES AND PRETEST:

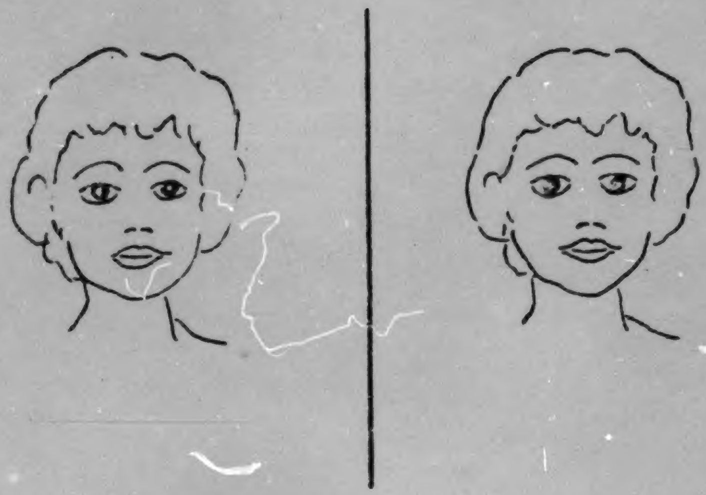
OBJECTIVES:

1. After coloring or shading a drawing of a face, you can identify the effect this has on changing the appearance.
2. After observing the effects that various "make-up" applications had on the drawing of a face, you can suggest which application would be useful in minimizing certain facial features.

EQUIPMENT: colored pencils.

PROCEDURE:

1. On the second drawing of each pair, shade or draw in the "make-up" according to the directions.
2. Underline your choice of the lettered alternatives that best describe the effect which the make-up had on the second drawing.
   a. shadow softly down the side of the face just below the temple to the beginning of the jawline with very light grey or tan pencil.



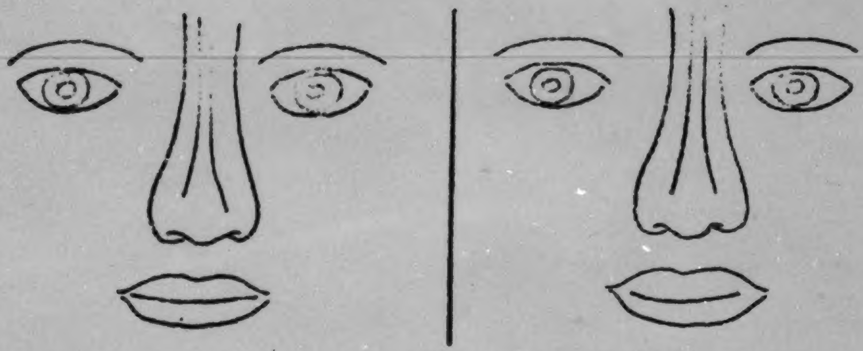
The shading:

a. narrows the face

b. widens the face

c. makes no difference

B. Shade along the sides of the nose with light grey or tan pencil.



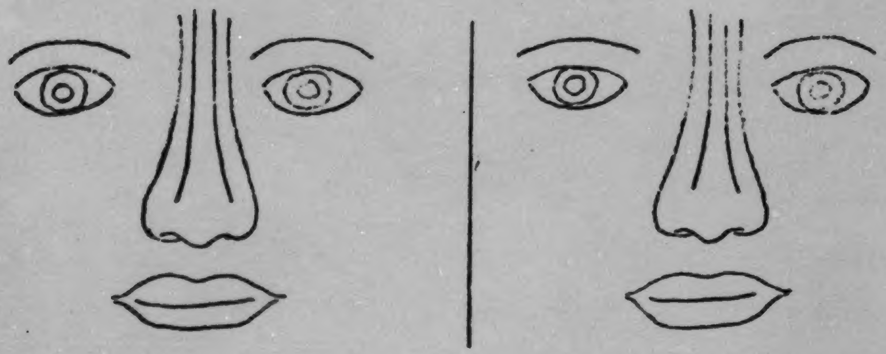
This shading:

a. widens the nose

b. makes no difference

c. narrows down the nose

C. Shade the area beneath the tip of the nose with light gray or tan pencil.



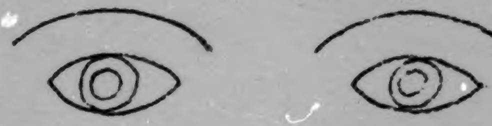
This shading:

a. turns down the nose

b. gives the nose a turned up look

c. makes no difference

D. With a dark pencil sketch in eye liner which is heavier at the center of the eye than at the outside corners.



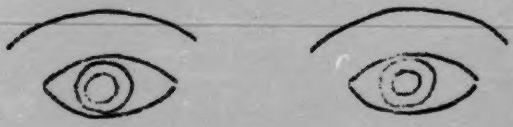
Heavier eye liner at
the center:

a. makes the eyes look closer together

b. makes the eyes look farther apart

c. gives the eyes a wide-eyed round look

E. Using green, blue, or grey pencil, shade the eye shadow from the center of each lid to the outer corner.



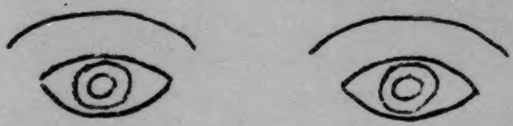
The eye shadow:

a. makes the eyes look closer together

b. makes the eyes look farther apart

c. gives the eyes a wide-eyed round look

F. Using green, blue or grey pencils, apply shadow at the corners of the lids which are nearest the nose.



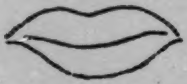
The eye shadow:

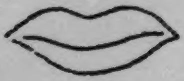
a. makes the eyes look closer together

b. makes the eyes look farther apart

c. gives the eyes a wide-eyed round look.

G. Using a red pencil, apply "lipstick", keeping the outlines slightly under the natural lip line.





The lipstick:

a. makes no difference

b. thickens the lip line

c. thins down the lip line

EVALUATION: (Assume the use of make-up in each case)

1. What would you do to give eyes a wide-eyed round look?

2. How can you make a nose appear thinner or shorter than it really is?

3. How would you make eyes appear farther apart?

4. How could you make eyes seem closer together?

5. Alter the facial diagram of the male on the right and describe what effect the alternation has on his appearance.

Effect:

____

____

____

____

____

RESOURCE: Uggams, Leslie, The Leslie Uggams Beauty Book, Prentice Hall. Englewood Cliffs, N.J., 1966, pp. 44-45.

MODULE: Optical Illusions Using Make Up

TEACHER SUPPLEMENT

PROCEDURE:

A. - a

B. - b

C. - c

D. - d

E. - b

F. - a

G. - c

EVALUATION:

1. Use a wider margin of eye shadow in the center of the eye lid.
2. Shade along the sides.
3. Apply eye shadow from the center of the lid to the outer corner.
4. Apply eye shadow from the center of the lid in toward the corner nearest the nose.

MODULE: Hair Spray Comparisons

CLUSTER: Personal Services

OCCUPATION: beauty operator
cosmetic technician
barber

PREREQUISITES AND PRETEST:

Define the following words:

1. propellant: ____________________
2. chemical carrier: ____________________
3. flammable: ____________________
4. solubility: ____________________

OBJECTIVES:

1. Given a variety of hair sprays you could test them and rank them according to;
    a. best holding ability
    b. fastest drying time
    c. least flammability
    d. least insect attraction
    e. best water solubility
2. Given a list of hair spray ingredients you can:
    a. list those used to hold the hair
    b. list those used to propel the spray out of the can
    c. list those used to scent the spray

EQUIPMENT:

several hair spray samples
ring stand with small ring
10 paper clips
2 - 4 microscope slides
2 - 4 cover slips

400 ml. beaker or equivalent
matches and cigarette (from teacher)
clock or watch with second hand
fan (optional)
water spray bottle (optional)

PROCEDURE:

1. Holding ability (NOTE: You may wish to test regular hold against super hold of the same brand)

   a. set up the ring stand and fasten the small ring about a foot above the base.

   b. pull a hair out of your head that is about twice the diameter of the small ring. If you don't have any that long ask a volunteer for a strand. You will need one hair for each hair spray sample.

NOTE: Throughout this activity you will be trying to spray equal amounts of hair spray on objects for test purposes. You must develop a system for spraying that gives you very nearly equal amounts. Perhaps counting evenly i.e. saying "one thousand one" while you spray may do this.

   c. spray two spots on opposite sides of the ring with one brand of hair spray. Remember that you must spray an identical amount of each of the others when you test them. Lay the hair strand across the ring so that each end is in the hair spray on the ring. Wait at least one minute and then spray an equal amount on top of the hair where it is stuck to the ring. Wait three minutes.

   d. you are now to carefully hang paper clips from the hair, one by one, until the hair slips from the ring. You may either hang the clips from the first clip placedon the hair or hang each clip directly on the hair. Count the number of clips needed to pull the hair from the ring and record in the data table.

NOTE: If the added clips do not cause the hair to slip, repeat step c., spraying just one spot instead of two.

2. Drying time

   a. spray a clean glass slide with a thin film of hair spray. You must be able to duplicate this amount of spray when you check the other samples!

   b. lightly touch a small section of the sprayed surface with your finger every 30 seconds. When the surface is very slightly tacky and little or no finger print is made, judge the surface to be dry. You may wait until no stickiness is felt but this will take a longer time. Record the time in seconds in the Data Table.

3. Flammability TEACHER DEMONSTRATED OR ASSISTED

   a. spray each hair spray sample through a burning match, or Bunsen burner flame, and note how well the spray burns. The color (blue means better or more complete burning than yellow) and sound (amount of roar) are indications of flammability.

   b. once the hair spray is lit try to get the spray to remain flaming when the match is removed. You will probably need to slightly reduce the amount of spray coming out of the can.

   c. repeat the test using a glowing cigarette in place of the match if your teacher can get one. The customers in a beauty salon may wish to smoke while they have their hair styled and you would know whether this could be permitted or not. Record all of your observations in the Data Table and rank the sprays with #1 being least flammable or safest.

4. Insect Attraction (limited by season)

Women have mentioned that they seem to get more mosquito bites and be more bothered by flies when they have used hair spray.

   a. make up an experiment to find out if this is true and try it.

   b. if it is true, experiment to find which of the hair sprays are most attractive to insects.

5. Water Solubility

   a. spray a clean glass slide with hair spray. You must be able to spray the same amount using the other sprays!

   b. place a clean cover slip on the sprayed slide about even with the edge of the slide. Let the spray dry, according to the time found in the drying time section.

   c. fill the beaker with room temperature water.

d. dip the slide and cover slip into the water and bring it out in a regular sequence like this: hold it under for 2 to 3 seconds and hold it above the water surface for 2 to 3 seconds, then repeat. Record the number of dips needed to make the cover slip slide off in the Data Table.

DATA AND RESULTS:

Data Table on the following page -

HAIR SPRAY TEST RESULTS AND RANKING

BRAND	OVERALL RANKING	HOLDING ABILITY (Number of Clips)	RANKING	DRYING TIME (seconds)	RANKING	FLAMMABILITY OBSERVATIONS	RANKING	WATER SOLUBILITY (Number of Dips)	RANKING

Rank the hair sprays first by individual test, with number one being the best. Then add up the rank numbers for each brand going across the Data Table. The brand having the lowest total, ranks number one overall. It may be interesting to include the price of each spray with the brand to see if the more expensive sprays are better in the tests you have done. Rank each hair spray overall.

NOTE: You might write to the manufacturers of each spray you tested asking for their test methods and results Include your results in your letter to them.

EVALUATION:

1. Show your completed Data Table to your teacher.
2. How will the results of your tests influence your hair spray purchase?
3. How does the cost of hair spray compare to quality? Check both the advertising on the can and your tests.
4. Some common hair spray ingredients are: lacquer, varnish, starch, gelatin, hydrocarbons like propane and butane, fluorochemicals like freon, alcohol, synthetic scents and others.
    a. find out which ingredients are used for:
        1. propellants:
        2. carriers:
        3. holding:
        4. odor:
    b. find out which ingredients are:
        1. flammable:
        2. dangerous to breathe:

Note: Call the Food and Drug Administration and ask them for the ingredients in hair spray. Also contact some hair spray manufacturers and ask them questions about what you need to know in question 4.

OPTIONAL ACTIVITY: TV Commercial Simulation

In a current TV commercial models spray their hair with two different brands of hair spray and then ride through a wind and rain machine. The brand which holds best in this "true to life" test is the sponsors and he hopes you were convinced enough to buy his product. You could try to duplicate this test by having several volunteers spray their hair equally with different brands of hair spray. Their hair should be similar in texture, length, and style.

TEACHER SUPPLEMENT

MODULE: Hair Spray Comparisons

They could take turns sitting about a yard or a meter in front of a fan for perhaps one or two minutes. The "rain" might be added, with the volunteer's permission, by using a fine spray bottle like those used to dampen clothes for ironing. It would be fun and helpful in judging to take Polaroid pictures before and after the wind and rain.

SAMPLE DATA:
We tested two hair sprays. White Rain regular - $1.28; and Aqua Net Super Hold - 58¢. Here is our data as we remember it.

Brand	Overall Ranking	Holding Ability	Ranking	Drying Time	Ranking	Flammability	Ranking	Water Solubility	Ranking	Ranking Score
White Rain Regular	Tie-1	3	2	3 min.	2	less roar	1	6 dips	1	6
Aqua Net Super	Tie-1	5	1	2½ min.	1	louder roar	2	8 dips	2	6

The insect attration would have to be done when there are insects flying so this is limited by weather and season. From experience we have found that some hair sprays do attract flies and mosquitoes.

ANSWERS TO EVALUATION QUESTIONS:

1. -
2. Hopefully the hair spray which has the best score will be used. One factor not considered was the scent, since most sprays may be purchased in the unscented variety.
3. In our tests there was no direct correlation. Advertising has a great influence on the cost and purchase.
4. Propellants: hydrocarbons, freone

   carriers: alcohol

   holding: lacquer, varnish, starch, gelatin

   odor: synthetic scents, alcohols

   flammable: alcohol, hydrocarbons, lacquer, varnish, starch (in fine spray)

   dangerous to breathe: hydrocarbons, lacquer

MODULE: Microscopy

CLUSTER: Agri-Business & Natural Resources

OCCUPATION: agricultural engineer
- agriculture extension agent
- agronomist
- county agriculture agent
- crop and soil scientist
- dairy technologist
- forestry technician
- horticulturist
- conservation officer
- ranger - manager
- water management technician
- wildlife manager
- wildlife worker

CLUSTER: Consumer, Foods & Homemaking

OCCUPATION: food technologist
- home economist
- technologist - dairy
- technologist - food

CLUSTER: Environment

OCCUPATION: oceanographer

CLUSTER: Personal Services

OCCUPATION: barber
- beauty operator
- cosmotologist

CLUSTER: Public Services & Related Professionals

OCCUPATION: anthropologist

OCCUPATION: barber
beauty operator
bio-chemist
custom inspector
detective
elem. school teacher
F.B I. Gov't. inspector & engineer
policeman & policewoman
secondary school teacher
zoologist

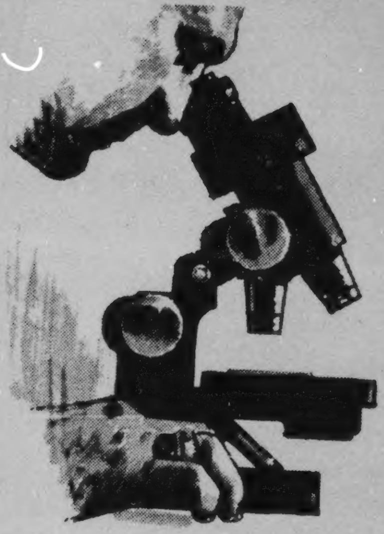
CLUSTER: Medicine & Health

OCCUPATION: dental lab technician
doctor - medical
engineer - sanitary
medical lab ass't.
medical lab. technologist
micro biologist
nurse - practical
nurse - public health
nurse - registered
pest control officer
physician
veterinarian

CLUSTER: Business & Office

OCCUPATION: lawyer

PREREQUISITES AND PRETEST: Knowledge of the use of a mircoscope using prepared slides.



MODULE: Microscopy I - Human Hair

OBJECTIVE:

1. Given the materials you can prepare and examine a temporary whole amount of human hair.

EQUIPMENT AND MATERIALS:

microscope
microscope slides
forceps
medicine dropper
cover slip
water
a few clippings of human hair

PROCEDURE:

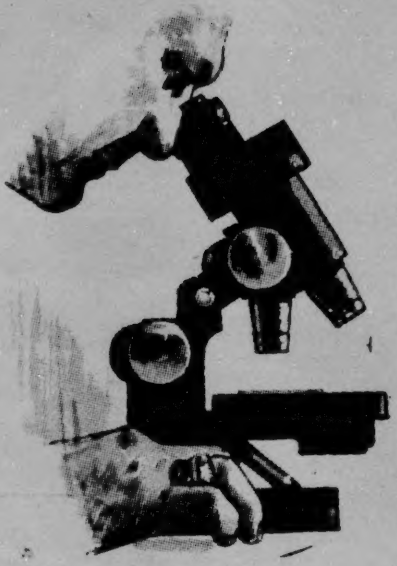
1. Using the medicine dropper, put a drop of water onto the microscope slide.
2. Add a few pieces of hair to the drop of water.
3. Place the cover slip over the hair and the water drop. To do this properly:
   a. position an edge of the cover slip near the edge of the water drop
   b. slowly and carefully, lower the cover slip over the drop of water (if you have trouble with this your teacher will demonstrate for you)
4. Examine the hair carefully under the microscope using low power.
5. Select hair sa[illegible]s from several different people. Try to get as many different kinds of samples as possible.

DATA AND RESULTS:

1. Do all human hairs look alike under the microscope?
2. What differences can you detect among the hairs?
3. Does some hair look healthier than others?
4. Do you think a detective could use pieces of hair found at the scene of a crime for evidence?

TEACHER SUPPLEMENT

MODULE: Microscopy I - Human Hair



MODULE: Microscopy II - Whole Mounting

OBJECTIVES:

1. Given the materials you can prepare a permanent whole mount of a small object.

EQUIPMENT:

microscope slide
slip cover
forceps
alcohol solutions
- 30% alcohol
- 50% alcohol
- 70% alcohol
- 95% isopropyl alcohol
- 100% anhydrous alcohol

zylene
Canada balsam
2 specimens of the same type such as an insect wing, small feather, scale, etc.

PROCEDURE:

1. Using the forceps place the specimen in the 30% alcohol solution. Leave it there for 10 minutes.
2. Remove the specimen and place it in the 50% alcohol solution, again leaving it there for 10 minutes.
3. Continue by placing the specimen in the 70% alcohol solution, 95% alcohol solution and the 100% alcohol, leaving the specimen in each solution for 10 minutes.
4. Place the specimen in the xylene for 10 minutes.
5. Place the specimen on the center of a microscope slide.
6. Place one drop of Canada balsam on top of the specimen.
7. Cover the specimen with a cover slip.
8. Be sure to press the cover slip down carefully, removing all air bubbles.
9. Make another slide of the same kind of specimen mounting it in water directly with no other preparation.

EVALUATION:

1. What physical characteristics must the object have before this method is useful?
2. What other objects could prepare in this way for examination under the microscope?
3. What advantage (if any) if there in making a permanent mount using the alcohol solution and the xylene?
4. What can you see with the specimen under the microscope that you could not otherwise see?
5. In what ways does this method fail to give a true picture?

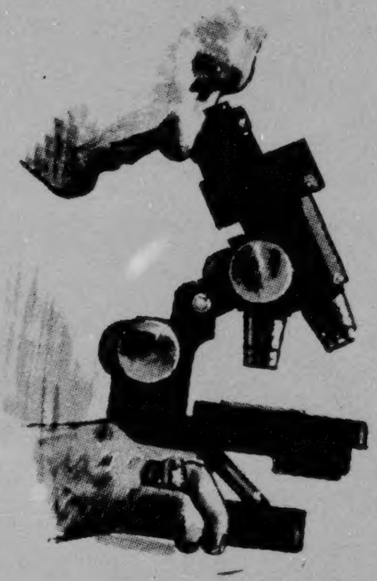
MODULE: Microscopy II - Whole Mounting

TEACHER SUPPLEMENT

ANSWERS: Evaluation

1. Small, transparent
2. Hair, insect winge, fish scales
3. The slide is permanent, the cell walls are more rigid, the specimen more transparent.
4. Depends on the specimen used.
5. The process of putting the specimen through the alcohol solutions and zylene destroys or at least changes some of the detail of this specimen.

MODULE: Microscopy III - Teased Preparations



OBJECTIVE:

Given the materials you can prepare tissue for examination under a microscope by teasing.

EQUIPMENT:
microscope slide
2 - dissecting needles
water
cover slip
medicine dropper
petal of flower (geranium, begonia or African Violet works well)

PROCEDURE:

1. Carefully remove a tissue from the petal of a flower.
2. Using two dissecting needles, pull the tissue apart.
3. Place the tissue in a drop of water on a microscope slide.
4. Carefully cover with a cover slip.

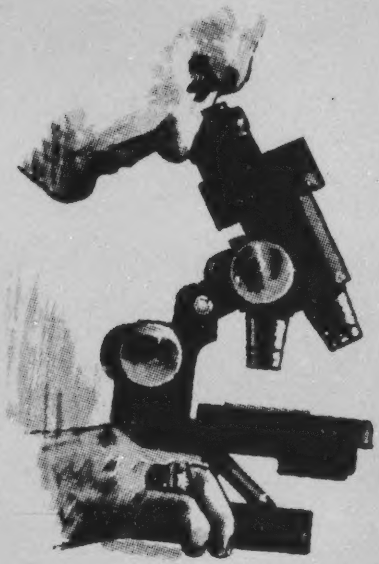
EVALUATION:

1. What physical properties must an object have if this method is to be used?
2. What other material would be good for this method?
3. What does the teasing method allow you to observe which would not be visible with a flat whole mount?
4. In what way does the teasing method fail to give you a true picture?

TEACHER SUPPLEMENT

ANSWERS: Evaluation

1. The material should be fibrous and easily pulled apart.
2. Muscle tissue, wood shavings, (after being softened), roots, nerve tissue.
3. The individual fibers.
4. Tearing the material apart alters the material.



MODULE: Microscopy IV - Squashes

OBJECTIVES:

Given the materials you can prepare properly a soft material for examination under a microscope by squashing it.

EQUIPMENT: microscope slide cover slip

small portion of an orange

PROCEDURE:

1. Place a small piece of orange (i.e. one of the little pieces that you find in orange juice) on a slide.
2. Place a cover slip over the piece of orange and very carefully squash it. (The cover slips are very fragile so do this very carefully)

EVALUATION:

1. What physical properties must an object have if this method is to be used?
2. What other materials would be good for this method?
3. What does the squash method allow you to observe which would not be visible with a whole mount?
4. In what way does the squash method fail to give you a true picture?

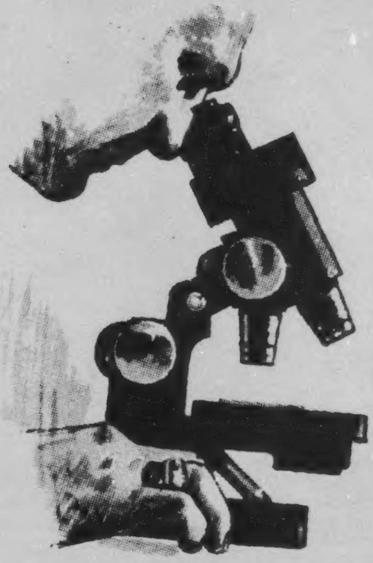
MODULE: Microscopy IV - Squashes

TEACHER SUPPLEMENT

ANSWERS: Evaluation

1. The material must be soft.
2. Flower stamen for pollen, soft flesh of fruit.
3. Individual cells.
4. The squashing of the specimen will change or destroy detail within the specimen.

MODULE: Microscopy V - Sections



OBJECTIVE:

Given the necessary materials you can prepare a thin section for examination under the microscope.

EQUIPMENT:

- single edge razor blade
- leaf to be sectioned
- forceps
- cover slip
- carrot
- pan of water
- microscope slide

PROCEDURE:

1. Split the end of the carrot lengthwise with the razor blade (caution).
2. Place the leaf into the slit end of the carrot.
3. Cut down through the leaf and carrot with the razor blade. Slice several very thin sections. (Caution: Razor blades cut fingers as well as carrots)
4. Float the thin sections of carrot and leaf in the pan of water.
5. Separate the sections of the leaf from the carrot and with the forceps place the section of the leaf on the microscope slide, cover with a drop of water and a cover slip.

EVALUATION:

1. What physical properties must an object have if this method is to be used?
2. What other materials would be good for this method?
3. What does the section method allow you to observe which would not be visible with the whole mount?
4. In what way does the section method fail to give you a true picture?

MODULE: Microscopy V - Sections

TEACHER SUPPLEMENT

ANSWERS: Evaluation

1. Must be hard and able to be sliced into thin slices.
2. Any soft stem or root tissue, or any plant or animal material that has been specially prepared.
3. Cell structure and the cell relationships within a specimen.
4. The cutting of the material will change or destroy some of the detail within the specimen.

MODULE: Microscopy VI - Bacteria Smear

OBJECTIVES:

Given the necessary materials you can prepare bacteria for examination under the microscope.

EQUIPMENT:

- Bunsen burner
- wire loop
- microscope slide
- methylene blue stain
- slide forceps
- paper towel
- microscope

METHOD: Caution - Bacteria must always be handled with care. Many types of bacteria can cause serious illness!!

1. Sterilize a wire loop by holding it in the flame of the Bunsen burner until it is red hot.
2. Use the sterilized loop to take up a growth of bacteria from the culture.
3. Smear the growth on the microscope slide.
4. Holding the slide with the slide forceps, pass the slide slowly through a low flame for five minutes. (Keep the slide moving or else it will get too hot in one place and break)
5. Stain the mounted specimen with methylene blue by -
    a. covering the specimen with the methylene blue stain, and letting it dry for 2 to 4 minutes.
    b. washing the excess stain off with water, and
    c. blotting dry with a paper towel
6. Observe the prepared bacteria slide under the microscope.

DATA AND RESULTS:

1. How many types of bacteria did you observe? Draw a picture of each type and give a brief description.
2. During what steps might the bacteria become damaged?

MODULE: Microscopy VI - Bacteria Smear

TEACHER SUPPLEMENT

ANSWERS: Data and Results

1. Possibly three main types spherical, rod shaped and spiral shaped.
2. a. smearing the bacteria on to the slide

   b. heating the slide over the flame

   c. staining and washing

MODULE: Mystery Story

CLUSTER: Public Service & Related Professionals

OCCUPATION: detectives

FBI agent

policeman & policewoman

CLUSTER: Business & Office

OCCUPATION: lawyer

PREREQUISITES AND PRETEST:

OBJECTIVES:

Presented with stories containing possible criminal activities you can play the role of an investigator and suggest possible explanations and relationships of the stories.

EQUIPMENT: pencil

METHOD: Read the following story and try to play the role as the story directs you. When the story asks you to react, very quickly do what you are asked to do. Write your comments or actions BEFORE reading on through the story.

SCENE ONE: You are a police officer walking through your patrol area. It is a nice warm sunny day. Your route takes you along a small park near the center of a large metropolitan area. Everything seems quiet and you like that. Suddenly you hear a loud bang and a scream coming from the park. As you are running toward the park you hear the screech of tires. As a police officer you have to make a detailed report as to what has happened. As you enter the park, what will you look for? (Use all five of your senses). What questions will you ask any possible witnesses?

1. What will you look for?

2. What questions will you ask possible witnesses?

Following is the actual police report:

Date: Sunday, 2 July, 1972 Time: 3:30 PM

Place: Central Park new 5th Street and 22nd Avenue

I was walking down 22nd Avenue near the park. I heard a loud bang and a scream coming from the park. Suspecting a possible crime I began to run toward the park. As I entered the park I spotted a woman (Mrs. Alma Peterson, 2801 W. 1st St.) who looked a bit startled. Upon questioning, she said she had been freightened by a "gun shot" and had screamed. She indicated that the "gun shot" sound appeared to have come from the street side of a thick growth of bushes near the corner of 5th Street and 22nd Avenue on 5th Street. She did not see a car driving away. Upon investigation of the area from which the sound had reportedly come from, I detected the odor of gun powder. There was, however, no sign of a body or wounded person. There was no trace of fresh blood. I did notice some broken glass in the street that I had not noticed when I passed the intersection earlier.

I went back to the woman and told her that apparently no one had been shot, and that it was probably (write what you think would be a logical explanation below)-

Police Officer's Explanation:

The police officer thought the most logical explanation was that some kid had thrown a firecracker and then raced off in his car.

SCENE TWO: You are again a police officer. This time you are talking on the phone to a frantic woman who is concerned about her husband. He had gone downtown to pick up her mother. This was over three hours ago. Her mother had called and he hadn't come yet to pick her up. What questions would you ask her that would help you solve her problem?

Questions that you would ask:

Actual police report:

Phone call, 2 July, 1972 6:15 PM

Mrs. Charles Quid, 3628 - 22nd Avenue, called concerned about her husband. He left home approximately 3:15 PM to pick up her mother at the bus station. (2201 - 5th Street). He was expected at the bus station at about 3:35 PM. His usual route downtown is to proceed north on 22nd Avenue and turn east on 5th Street. The car being driven is a 1971 Green Ford Wagon with Minnesota plates MAO 842. The patrol car in the area was notified to keep a lookout for the missing car.

1. Did you ask enough questions to get the information that is in the report?

2. Did the police officer fail to get some information that might have been useful?

3. What institutions could be contacted to help locate this woman's husband?

SCENE THREE: You and your partner are patrolmen. You are driving your prowel car on the north side of town. As you approach the river your partner suggests that you turn down the seldom used river road near the railroad tracks. As soon as you enter the river road you spot a suspicious looking car. You slow down and approach cautiously. As you get near the car you note that it is a green 1971 Ford Wagon with the right side of the windshield broken and the front and near left doors are open. You stop the car about 50 feet from the Ford and both you and your partner watch and listen for any signs of life. "Do you hear something?", was a question you both ask as you quickly run to the car. When you get there you find a man bodily wounded, laying on the floor of the car.

As your partner administers first aid to the wounded man it is your job to call in and make a report. What things will you include in your report and what kind of assistance will you request?

SCENE FOUR: You are a police detective reporting on duty at 6:30 PM. As you are approaching your office you get the message that you have just been assigned to a case involving a shooting. You quickly drive toward the location and as you are nearing the river, an ambulance rushes by you. You assume that that is your victim. As you enter the river road you see the squad cars and the attending patrol officers. The men appear to be busy searching the area around the Ford Wagon. You stop your car and begin to ponder the situation. What questions are you going to try to answer? What information might be hidden in the car and in the mind of the man in that ambulance?

1. What questions will you try to get answers to?

2. What information might be hidden in the car?

3. What information might be hidden in the mind of the victim?

This is the report that you get from the attending officers:

2 July, 1972 6:15 PM

As we turned down the river road off of State Highway #58 we spotted an abandoned car. (1971 Green Ford Wagon, Minnesota plates MAO 842) Inside the car we found the owner badly wounded. His ID is Charles Quid, 3628 - 22nd Avenue. He and the car had been reported missing since 3:15 P.M. There are no witnesses and the area is clean as far as we can see.

The car is sent down to the lab so that the car can be gone over with a fine tooth comb.

You are not at your office and are going over the report file for the day to see if you can possibly connect several stories together. You come up with the four reports that are in this activity.

1. What do you think holds these four reports together?

2. Write the story of what might have happened as you see it so far.

SCENE FIVE: It had been a long night and you finally get home and to bed at 4:30 AM. You are looking forward to a good long sleep, but sure enough you are awakened by the telephone. As you get up to answer you look at your watch and it is 10:00 AM and you wonder what it is this time. You learn that there may have been a break in your case. When you arrive at the station this is the report that you receive:

Phone call 3 July, 1972 9:30 AM

Reported a burglary at the CentralPark Jewelry Store, 2159 - 5th Street. Entry was made through a rear window after the alarm system had been disconnected. They removed from the store about $10,000 worth of "stones" and about $1,000 in cash.

The apparent get-a-way car (1970 Chevy) was found inthe alley behind the store with about half of the "stones" in a bag under the front seat. They had apparently tried to get away inthe car but the car failed to run. The car is registered under the name of Henry Billings and was reported stolen at 2:00 PM, 2 July, 1972.

1. How can this report fit in with the other reports?

2. What might have been the sequence of events that led up to the finding of Charles Quid shot in his own car on the old river road?

The next day you get a report from the hospital that Charles Quid has died. Now you have a possible murder case on your hands. Two days later you get a report on the two cars.

LAB REPORT: Ford Wagon - Fingerprints: None other than those of the owner and his family.

Items found: None other than those of the owner and his family.

*Microscopic study: Alfalfa pollen, and the pollen from alfalfa seeds, many kinds of weeds, weed seeds, cow hair, (Herford) brown hair from Caucasion (all members of the Quid family have black, Negroid Hair).

**Blood matching Charles Quid's blood

***Bacteriological study of the mud found in the car: Organisms found only in soil high in cow feces.

Chevy:

Fingerprints: None other than those of the owner and his family.

Items found: Bag of diamonds identified as belonging to the Central Park Jewelry Company. Bag of tools not belonging to the owner of the car.

*Microscopic study: Pollen - same as above

Seeds - same as above

Cow hair - same as above

Human hair - brown hair from same person as the one found in the Ford Wagon. In both cases the hair does not match the hair of the owner of the Chevy or his family.

***Bacteriological study of the mud found inthe car - matches the organisms found in the Ford Wagon.

*Module: Microscopy I, II, III, IV, V, VI

** Module: Preparation of Blood Smears

***Module: Soil Microorganisms I - Soil Bacteria

Soil Microorganisms II - Soil Amoeba

As the detective in charge of this case where would you go from here?

TEACHER SUPPLEMENT

MODULE: Mystery Story

MODULE: Test Construction

CLUSTER: Public Services and
Related Professionals

OCCUPATION:
teacher
coach
public relations worker

PRETEST:

OBJECTIVE: You can write a test to measure the knowledge of a group of people on a topic of your choice.

EQUIPMENT AND MATERIALS:

PROCEDURE:

1. Choose a topic that you like. Choose something that you know a lot about. This may be a popular singer of actor, a musical group, a movie that you especially liked, a sports figure, or an athletic team that you have a lot of interest in, etc. (Refer to Module: Developing a Lesson Plan)
2. Gather together all the information that you can about this topic. This may include books, magazines, newspaper articles, movie reviews, talking to people, etc.
3. Write down questions that you think people should know about this topic. Try to write about 14 good questions.
4. The most common type of questions in the evaluation of students is the multiple choice question. This is the type that we will use here. This is how they are written.
    a. First write down the question.
    Example: What is a teenager;
    b. Write the correct answer.
    Example: Anyone that is 13 through 19 years old.

c. Write three more answers that are partly correct.

Example X: Anyone that is 11 through 20 years old.

Example Y: Anyone that is 13 through 20 years old.

Example Z: Anyone that is 12 through 19 years old.

d. Do not provide answers which are obviously wrong.

5. You now have a question and four possible answers like this:

What is a teenager?

Anyone that is 13 through 19 years old.

Anyone that is 11 through 20 years old.

Anyone that is 20 through 35 years old.

Anyone that is 65 years old or older.

6. Many times you can make your question simpler like this:

A teenager is anyone that is:

13 through 19 years old

11 through 20 years old

13 through 20 years old

12 through 19 years old

When you write them in this form use index cards.

7. Now you must assign a letter to each answer. The best way to do this is to cut out the 24 possibilities of arranging the letters A.B.C.D. from the last page of this activity paper. Then mix the pieces of paper in some kind of a container. For each question draw out a slip of paper and assign the letters to answers.

Example: I reach into the container and draw the slip with B,D,C,A.

A teenager is anyone that is:

B. 13 through 19 years old
D. 11 through 20 years old
C. 20 through 35 years old
A. 65 years old or older

8. When you have assigned letters to all the answers, write the questions out in your final test form.

Example:

Test: Buying a Used Car

NAME____________________ DATE____________________

AGE________ CLASS__________ PERIOD__________

Number your answer sheet from 1-14. Do not write on this test. Write the letter of the correct response after the corresponding number on your answer sheet.

1. A teenager is anyone that is:

   A. 65 years old or older
   B. 13 years through 19 years old
   C. 20 through 35 years old
   D. 11 through 20 years old

2.

EVALUATION:

Ask a few of your friends to take your test. Have them record their answers on an answer sheet, not your test. Grade their test and then get their reaction. They might complain that some of the questions were confusing or that some of the answers are a matter of opion. In each case, try to rewrite the question and answers so that they are much more clear.

FURTHER ACTIVITIES:

Once this is done, you are ready to use your test. Use Module: Using a Written Test for Measurement.

ALL POSSIBLE WAYS OF ARRANGING THE LETTERS A, B, C, & D

Cut out and place the squares in a container. Draw one out for each question to help you to know how to arrange your possible answers for each question.

A B C D	A B D C	A C B D	A C D B
A D B C	A D C B	B A C D	B C A D
B C D A	B D A C	B D C A	C A B D
C A D B	C B A D	C B A D	C B D A
C D A B	C D B A	D A B C	D A C B
D B A C	D B C A	D C A B	D C B A

TEACHER SUPPLEMENT

MODULE: Test Construction

MODULE: How Do People Learn?

CLUSTER: Public Services & Related Professionals

OCCUPATION: teacher

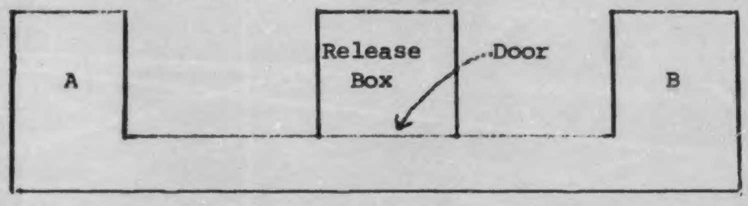
PREREQUISITES AND PRETEST:

OBJECTIVES:

One thing that a teacher is deeply involved with is trying to answer the question; How do people learn? One way that we can try to answer this question is by observing how people and animals learn. In this activity you will be attempting to observe the learning behavior of a gerbil.

EQUIPMENT:

- large T-maze
- gerbil
- toys for the gerbil



T - Maze for the gerbil

PROCEDURE:

1. Place the gerbil in the release box.
2. Place his toys in box A.
3. Release the gerbil by opening the door to the release box.
4. Time how long it takes the gerbil to reach his toys in box A. If he doesn't reach box A within 5 minutes, return him to the release box and count that trial as a failure.
5. If he goes to box B return him to the release box and begin a new trial.
6. If he goes to box A allow him to remain there for 3 minutes.
7. Record your data for each trial as follows:
   a. if the gerbil goes to box A check the box under the label "success" and enter the time that it took him under "time".
   b. if the gerbil goes to box B check the box under the label "failure".

8. Repeat the trials until the gerbil goes to box A almost every time.

9. Reverse the situation and see how long it takes the gerbil to learn to go to the new reward area.

10. Optional Method: Use a hamster, mouse or rat and reward with food.

DATA AND RESULTS:

HOW DO GERBILS LEARN - DATA SHEET

Do not move toys to B until all trials to A are complete

Trial Number	Time Length of Trial	Toys in Box A Success	Toys in Box A Failure	Toys in Box B Success	Toys in Box B Failure
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

1. How many trials did it take before the gerbil learned to go to Box A?
2. What other things could you use besides toys to get the gerbil to learn?

EVALUATION:

1. Did it take any more or less time for the gerbil to learn to find the toys in B after he had already learned to find them in A?
2. If there was a difference in learning time between A and B, how could you explain this?
3. What kind of "rewards" do teachers use to get their students to learn?
4. What kinds of "rewards" might work better?

FURTHER ACTIVITY:

1. For variation take a different animal and study his learning behavior under a different situation.
   a. Provide no reward for going into box A. In other words no toys to play with.
   b. Again release the gerbil and time how long it takes for him to go to box A.
   c. If he goes to box B make a loud noise with a symbal, bell or buzzer. This will make going into box B a freightening experience.
   d. If the gerbil goes to box A allow him to remain there for 3 minutes.
   e. Repeat the trials until the gerbil goes to box A almost all the time.
   f. Reverse the situation and see how long it takes the gerbil to learn to avoid the new "loud noise" area.
2. Another method you could use to study the behavior of the gerbil would be to allow the gerbil to live in the T-maze and simply observe where the gerbil spends his time, what things he does in certain areas, etc.

TEACHER SUPPLEMENT

MODULE: How Do People Learn?

MODULE: Using a Written Test for Measurement

CLUSTER: Public Services & Related Professionals

OCCUPATION: teacher

guidance counselor

PRETEST AND PREREQUISITES:

1. Do module - Test Construction.
2. Add the following columns of numbers and find the average. Round off to the nearest whole number.

a.	b.	c.
20	11	21
24	13	24
19	9	19
15	18	23
17	21	22
13	24	20
Average =	Average =	Average =

3. Find the following percentages. Round off to the nearest percent.

a. 18 is__________% of 24.

b. 16 is__________% of 24.

c. 11 is__________% of 24

OBJECTIVE:

1. Using a test of your own construction, you can:
   - a. compare the knowledge of one individual with that of another individuals.
   - b. compare the knowledge of one group with that of another group.
   - c. measure the growth of an individual.
   - d. measure the growth of a group.

EQUIPMENT AND MATERIALS: paper pencils

the test you made up in the Module: Test Construction

PROCEDURE:

A. Compare what one person knows with what a goup of people know.

1. Give your test to a group of people. One of your classes will do.
2. Score the tests. Use the number of correct answers as the score.
3. For each score place a slash mark (i.e. /) on table 1 in Data and Results.

4. Assign a letter grade to each test (A,B,C,D, or F).

B. Compare one group with another group.

1. Choose two groups that you would like to compare.
    a. girls with boys
    b. teachers with students
    c. 7th grade with 9th grade
    d. etc.
2. Give the test to each of the two groups.
3. Score the tests. Be careful not to mix the two groups.
4. Add up the scores from each group and find the averages by dividing the sum by the number of people in the group.
5. To find the percentage correct, divide the averages by the number of questions in the test.

C. Measure the growth of an individual.

1. Give the test to the individual as a pre-test before he has studies the topic.
2. Score the test.
3. Give him a lesson on the topic of the test. (See Module: Lesson Plan)
4. Give him the test (you may want to give him another version of the test or give him the odd numbered questions before and the even numbered questions after the lesson.)
5. Score his test.
6. Compare the second test score with the first.

D. To measure the growth of a group use the same procedure as for C. Only determine the average of the group for before and after the lesson and then compare the two averages.

DATA AND RESULTS:

TABLE I

NUMBER CORRECT	GRADE	NUMBER OF TESTS WITH EACH SCORE OR NUMBER CORRECT
14		
13		
12		
11		
10		
9		
8		
7		
6		
5		
4		
3		
2		
1		
0		

TABLE 2 - COMPARISON OF TEST SCORES

	B		C		D	
Comparison of	Group One	Group Two	Ind. 1st score	Ind. 2nd score	Group 1st score	Group 2nd score
Average or Individual Score						
% Correct						

MODULE: Using a Written Test for Measurement

TEACHER SUPPLEMENT

PRETEST ANSWERS:

2. a. 18
   b. 16
   c. 22

3. a. 75
   b. 67
   c. 46

MODULE: Developing a Lesson Plan

CLUSTER: Public Service & Related Professionals

OCCUPATION: teacher

coaches

PREREQUISITES AND PRETEST:

OBJECTIVES:

You can write a unit lesson plan and a daily lesson plan by writing questions that you would like students to answer and by determining how students can find the answers to these questions.

EQUIPMENT AND MATERIALS:

paper and pencils

reference materials

PROCEDURE:

1. Decide what kind of a teacher you might want to be. Include the following:
    a. the grade level that you are going to teach
    b. the subject area in which you are going to teach (i.e. math, English, social studies, science, etc.)
2. Determine your objectives (what you would like to teach) for this particular unit. It might be helpful to you to write what you would like to teach in the form of a question. For example, if you want to teach a group of students the procedure of picking out a car at a used car lot, you might start out by asking the question "What should you know about a used car before you buy one?" Record your opening question inthe unit plan table at the end of this module.
3. Think about the question that you wrote and try to think of some more questions that might help you answer this first one. For example, to help answer the sample question, you might ask some of the following questions:
    a. how old is the car?
    b. how many people have owned the car?

c. how many miles are on the car?

d. has it ever been in an accident?

e. (See if you can write some more questions on what you should know about used cars)

f.____

g.____

h.____

Write as many questions as you can about your opening question on the lesson plan table at the end of this module. (If you need more room continue on the back of this page)

4. Number the questions in the order you would like to present them.
5. Now take a look at your questions. (By the way, feel free to add to your list of questions at any time) Try to think up activities that you could have your students do to answer these questions. Which ones could best be answered by:

a. discussion	or by a combination of these:
b. reading	a. movie and discussion
c. movies	b. lecture and discussion
d. lecture	c. etc.
e. activity	
f. other	

6. List on the unit plan table the method that you would like to use for each question. Also list the resources that you would like to use. (Film, slides, filmstrips, books, etc.)
7. Determine the amount of time that you would like to spend on each question and then determine the number of class periods thatyou will need.

8. You now have what could be called a unit lesson plan.

9. To write a daily lesson plan select one day's work and write in detail what you plan to do. Example: You may not be able to depend on the salesman to tell you if the car has been in an accident. So to help the perspective buyer answer the question, "Has the car been in an accident?" Have the students do the following activity.

SAMPLE ACTIVITY: Looking for indications that a car has been in an accident.

OBJECTIVE: To be able to detect non-magnetic fillers used to fill up dents in fenders.

EQUIPMENT AND MATERIALS:

small magnet

car that has been in an accident and has been repaired by use of a filler

PROCEDURE:

1. Take the small magnet and touch the fenders and doors of the car.
2. The places that there is a "pull" between the car and the magnet, there is metal on the other side of the paint.
3. The places that there is no "pull" between the car and the magnet, there is probably a non-magnet type filler on the other side of the paint.

NOTE: If you find places where the filler has been used you can be sure that the car had been repaired in a body shop. If you find no such filler there still is the possibility that the car had been in an accident.

On the following daily lesson plan form, write in detail at least one or more activity that you could have your students do.

10. When you have finished, show your unit and daily lesson plans to one of your teachers and he may help you with them and let you try them out in his class.

EVALUATION: If you were able to actually present your daily lesson to a class -

1. Did you estimate the time required to do your daily lesson plan correctly? If not, how could you change your lesson plan?

2. Were the students interested in the lesson? Give some examples of their interest or lack of interest.

3. What could you do differently that would make your lesson more interesting for the students?

4. How could you tell whether or not the objective(s) were reached?

DAILY LESSON PLAN FORM

Questions to be answered:

1. ______________________________

2. ______________________________

3. ______________________________

OBJECTIVES:

DESCRIPTION OF METHODS TO BE USED:

RESOURCES AND MATERIALS:

317A

UNIT LESSON PLAN TABLE

Question: ______________________________

Opening Question	Method	Resource	Number of Class Periods

TEACHER SUPPLEMENT

MODULE: Developing a Lesson Plan

MODULE: Paper Chromatography I - Ink

CLUSTER: Public Services & Related Professionals

OCCUPATION: detective

FBI agent

policeman & policewoman

PREREQUISITES AND PRETEST:

OBJECTIVES: By using chromatography of three known inks you can identify an unknown ink.

EQUIPMENT: different brands of black colored felt tipped pens and/or fountain pens filled with different brands of black ink

4 pieces of filter paper

1 medicine dropper

masking tape

PROCEDURE:

1. Label the pens 1, 2 and 3, using masking tape.
2. Take the three pieces of filter paper and label them 1, 2 and 3.
3. Place a drop of ink from the pens on the matching filter paper.
4. Have a friend choose one of the three pens while you are not watching.
5. Add 3 drops of water to the ink on all four filter papers.
6. Compare the color patterns of the three known pens with the color patterns of the unknown pen. Can you tell which kind of ink your friend used?

DATA AND RESULTS:

1. Did you get a separation of colors for each type of ink?______________
2. If so, what colors separated out for each pen?
   a. pen number 1____
   b. pen number 2____
   c. pen number 3____

EVALUATION:

1. Of what practical value would this method of identification be to a police officer?

2. Other than ink, what other substance might be tested by this same method?

FOR FURTHER ACTIVITIES:

Do the same activities, only use a solvent other than water (i.e. use 3 drops of alcohol on the drops of ink, rather than water). Does this procedure make it any easier to find the identity of the unknown?

MODULE: Paper Chromatography I - Ink

TEACHER SUPPLEMENT

ANSWERS:

EVALUATION:

1. He could use this method to help establish whether or not a note was written by a specific pen.
2. Any liquid containing pigments.

MODULE: Paper Chromatography II - Chlorophyll

CLUSTER: Public Services & Related Professionals

OCCUPATION: bio-chemist

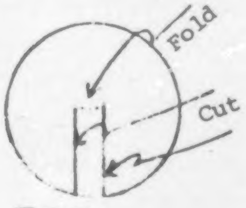
OBJECTIVES:

You can extract chlorophyll from leaves and separate it into its components by means of paper chromatography.

EQUIPMENT:
leaves from two different kinds of plants (spinach, coleus, jeranium, etc.)
600 ml. beaker water
hot plate
100 cc methyl alcohol
disk of filter paper
250 ml. beaker
scissors

PROCEDURE:

1. Place the leaves from the first plant in the 600 ml. beaker.
2. Cover the leaves with water and heat to boiling on a hot plate.
3. Allow the leaves to boil for five minutes.
4. Meanwhile, pour 50 cc. of methyl alcohol in the 250 ml. beaker.
5. When the leaves have boiled for 5 minutes, remove them from the water and place them in the beaker of alcohol.
6. After the color has left the leaves and the alcohol has turned green, disgard them.
7. Cut and fold the filter paper as shown in the diagram below.



8. Place the filter paper over the beaker and allow the cut strip to dangle into the solution.
9. Observe and record what happens.
10. Try this with the second type of leaves.

DATA AND RESULTS:

1. What colors were separated out on the filter paper?______________________________

2. Do both kinds of leaves have the same colors of chlorophyl in the same amount? Describe what you have found by observing the color patterns on the filter paper.____

____

____

3. In what way could chromatography be used to identify plants?__________________

____

EVALUATION:

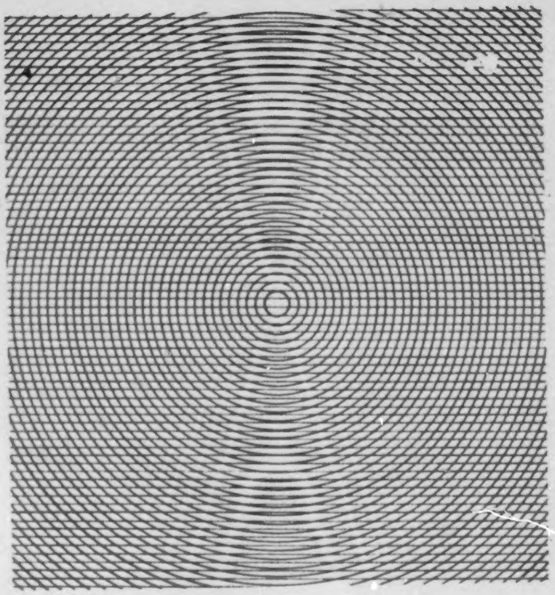
Describe what would happen if you put alcohol on your slacks to remove grass stain.

TEACHER SUPPLEMENT

ANSWERS:

EVALUATION:

The alcohol would move and separate the chlorophyll pigments. To remove the stain you would have to rinse out the pigments with alcohol.



MODULE: Do you See What I See? Part I

CLUSTER: Public Services & Related Professionals

OCCUPATION: public relations worker

CLUSTER: Business & Office

OCCUPATION: lawyer

CLUSTER: Fine Arts & Humanities

OCCUPATION: artist

PRETEST AND PREREQUISITES:

OBJECTIVES:

1. The student can demonstrate that different people react differently to the same stimuli (using ink blots as the stimuli).
2. The student can point out to someone a form in the ink blots that that person had not seen originally.

EQUIPMENT: ink blots (See "How to Make Ink Blots" at the end of this activity)

METHOD:

1. Show the set of ink blots to 5 people.
2. Ask each person what objects they see in each ink blot and record their response in the proper place in the data table.
3. Go back to each of the people you have interviewed and try to get them to "see" the same things as other people have seen.

DATA AND RESULTS:

DATA TABLE: INK BLOT DESCRIPTIONS

	1	2	3	4	5	
Name of person being interviewed						
Response to ink blot number 1.						
2.						
3.						
4.						
5.						

EVALUATION:

1. At first did everyone that you interviewed "see" the same thing?

2. If not, were you able to get everyone to "see" the same thing? If so, how did you do it? If not, why?

FURTHER ACTIVITIES: Try the same activity using a modern abstract art form. Get art reproductions from the library or from your art teacher. Or create art work yourself.

HOW TO MAKE INK BLOTS

MATERIALS:	paper	India ink (or Tempera paints)
	small brush	

PROCEDURE:

1. Fold a piece of paper in half.
2. Unfold the paper and on one half of the paper place drops of ink or paint.
3. Refold the paper and rub and press the ink out so that it forms a pattern on both halves of the paper.
4. Unfold the paper and allow it to dry.

MODULE: Do you See What I See? Part I

TEACHER SUPPLEMENT

ANSWERS:

PRETEST:

1. Persuade - To induce (one) to believe or do something.
2. Logic

   Appeal to emotion

   Fear

   Reasoning

CAN'T SEE THE FOREST FOR THE TREES

MODULE: Do you See What I See? Part II

CLUSTER: Public Services & Related Professionals

OCCUPATION: public relations worker

CLUSTER: Business & Office

OCCUPATION: lawyer

PRETEST AND PREREQUISITES:

1. Look up the definition for persuade.
2. List three methods that you could use to get someone to change their mind.

a. ______________________________

____

b. ______________________________

____

c. ______________________________

____

OBJECTIVE: Talk about the relationships shown in a picture on drawing in such a way that two groups of people (or individuals) come to see the same relationships.

EQUIPMENT: drawings or photographs having a high emotional level (the subject matter could be concerned with such topice as pollution, war, elections, drmonstrations, integration, etc. Magazines, newspapers and the student's own art work are good sources)

METHOD:

1. Show the photographs or drawings to students and teachers and get their reactions to them. Record these reactions in the data table. (You will have to copy the sample data table below. Make one copy for each of the persons that you interviewed)
2. Once again go to these same individuals. Only this time try to persuade them to see the picture differently.

DATA AND RESULTS:

SAMPLE DATA TABLE: REACTIONS TO PICTURES

NAME:

PICTURE NO.	REACTION
1	
2	
3	
4	
5	

EVALUATION:

1. Did you find that different people reacted differently to the pictures?

2. Did you find it possible to change some people's minds?

3. Did anyone change your mind?

4. What personal factors influence the way that people "see" things?

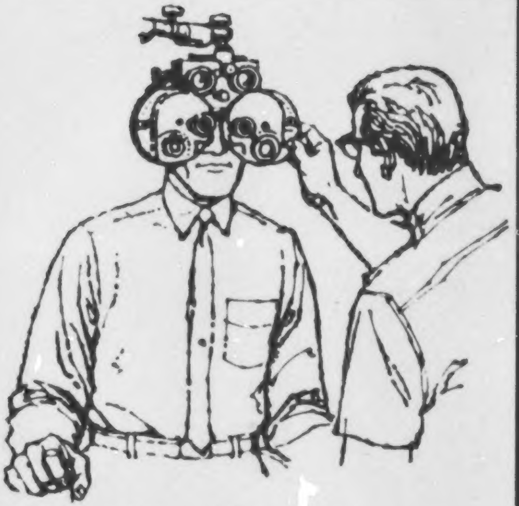
FURTHER ACTIVITIES:

1. Look at the pictures and formulate an opinion of your own.

2. Go to several individuals and attempt to persuade them to see the pictures the same way that you do.

TEACHER SUPPLEMENT

MODULE: Do you See What I See? Part II



MODULE: Do You See What I See? Part III

CLUSTER: Public Services & Related Professionals

OCCUPATION: public relations workman

CLUSTER: Business & Office

OCCUPATION: lawyer

PRETEST:

OBJECTIVE: You can represent one side of a controversary and in doing so persuade other people to come around to his side.

EQUIPMENT: articles on controversial topics like integration, pollution, etc.

METHOD:

1. Take the written material and choose* to represent one side or the other of the controversy.
2. Have other people read the article.
3. Determine their views and attempt to persuade them to come around to your position.
4. Write up a one page report for each interview. Explain:
    a. their views
    b. how you tried to persuade them
    c. the effects of your efforts to persuade

ALTERNATE METHOD:

1. Take the written material and have several people read it. Record the people's reactions to the materials.
2. Rewrite the material in such a way that these same people will react to it in a new way.

*A public relations worker may find himself in a position where he will be forced to support a position that he would not normally want to support.

TEACHER SUPPLEMENT

MODULE: Do you See What I See? Part III

MODULE: Flight Instrument Readings

CLUSTER: Construction & Repair

OCCUPATION: airline mechanic

CLUSTER: Manufacturing

OCCUPATION: aeronautical engineer

CLUSTER: Transportation

OCCUPATION: airline pilot-copilot

PREREQUISITES:

OBJECTIVES:

1. Using reference materials you can:
    a. name at least five measurement indicators on a pilot's flight instrument panel.
    b. explain what each of these instruments measures.
    c. explain how each of these measurements is important for aid to navigation.
2. You can describe how each of the measuring devices would react if the plane were flying through a storm.

EQUIPMENT: Reference materials on airplanes and their instrumentation.

PROCEDURE:

1. By examining the reference materials available, list in the first column five different flight measurement indicators which are found on an airplane instrument panel, but not on an automobile dashboard.
2. In the second column, explain what each instrument measures.

3. In the third column, explain how you would expect each of these instruments would react when flying through a thunder storm.

DATA AND RESULTS:

INDICATOR	WHAT IS MEASURED	EFFECTS DURING THUNDERSTORM

MODULE: Flight Instrument Readings

TEACHER SUPPLEMENT

DATA AND RESULTS: Some of the possibilities are:

INDICATOR	WHAT IS MEASURED	EFFECTS DURING STORM
Altimeter	The airplane's height	rapid fluctuation
Air speed indicator	How fast the plane is moving through the air regardless of ground speed	relatively unchanged
Compass	Geographical direction	may change slightly
Course deviation indicator	Deviations (in degrees) of the desired course	more likely to show change
Vertical speed indicator	Rate of climb or descent	rapid fluctuation
Horizontal direction indicator	Plane's attitude in air	may change more than usual

MODULE: Emergency Procedures & First Aid
While in Flight

CLUSTER: Transportation

OCCUPATION: airline stewardess

PREREQUISITE:

Be able to research the information you need in the library and from other reference materials.

OBJECTIVES:

When presented with some emergency situations which you may face as a stewardess, you can suggest, with the aid of references, what appropriate action should be taken. (Remember that in an actual situation a stewardess does not have a flying library and must rely only on memory, past experience, and common sense for references)

EQUIPMENT: library

PROCEDURE:

After each of the emergencies suggested below, describe just how you as a stewardess would handle the situation.

DATA AND RESULTS:

1. A passenger faints.

2. A passenger is unable to be awakened at the end of a flight.

3. A passenger on his first flight becomes hysterical due to his fear of heights.

4. A passenger sticks a gun-like object in your ribs and wants you to get the pilot to fly to Mexico.

5. Engine number four catches fire.

6. The heating element of the food compartment is faulty and provides no heat. Dinner time is one hour away.

7. A customer insists on smoking right before take-off.

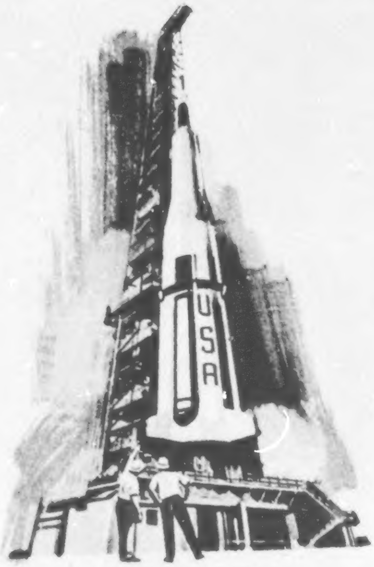
8. A baby cries continually on an all night overseas flight and is disturbing many of the passengers.

EVALUATION:

Turn in your emergency plans to your instructor.

TEACHER SUPPLEMENT

MODULE: Emergency Procedures & First Aid While in Flight



MODULE: Paper Airplanes & Principles of Flight

CLUSTER: Construction & Repair

OCCUPATION: airline mechanic

CLUSTER: Manufacturing

OCCUPATION: aeronautical engineer

CLUSTER: Transportation

OCCUPATION: airline pilot-copilot

PREREQUISITES:

Be able to explain each of the following aeronautical terms:

a. Roll____

____

b. Glide____

____

c. Pitch____

____

d. Yaw____

____

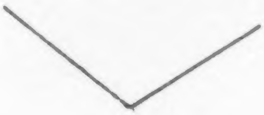
OBJECTIVES:

1. Using paper, cellophane tape, and staples, you can design, make and fly three different models of paper airplanes which will fly in a straight line for a given distance.
2. If the planes do not fly properly as to direction or distance, you can change their design to correct the problem.
3. Using reference materials you can write a brief description, with diagrams if desired, of how rolling, pitching and yawing are each prevented in actual aircraft.

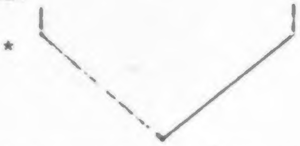
EQUIPMENT:
8 1/2" x 11" paper
transparent or masking tape
stapler & staples
staple remover
meter stick
scissors

PROCEDURE:

1. Make three paper airplanes, each of a different design. You may use tape or staples to weight them where necessary.
2. Your models may be of the glider type which is held high and merely shoved off into the air. The models could also be of the dart type which requires a very vigorous thrust from your arm and wrist.
3. To prevent rolling or tipping sideways you can stabilize the plane laterally by giving the model a dihedral angle. To do this, fold the wing along its center line so that it becomes a model with two wings, whose tips are higher than its center line



4. If the model yaws, that is turns off of a straight course to the left or right, bend up along each wing a 1/2" strip*. These are called rudders. Also, be sure to check that your model is symmetrical, exactly the same on each side of the center fold.



5. You can stabilize your model to prevent pitching or turning nose up or nose down by adding or removing weight from the nose. Such weight is changed by multiple paper folds, tape, or staples. Turning the tail edge up or down will also make a difference.

DATA AND RESULTS;

Record the direction and distance performance directly on each plane and hand it in to your instructor.

EVALUATION:

1. If your dart models do not fly at least 35 ft. and the glider models at least 20 ft. in a straight line, reform the model according to the suggestions in the procedure.
2. Explain in your own words how an actual aircraft is stabilized for:
   a. yawing:

   b. rolling:

   c. pitch:

RESOURCE: Barnaby, Capt. Ralph A. How to Make and Fly Paper Airplanes,
Bantian Books, N.Y., 1968.

MODULE: Paper Airplanes & Principles of Flight

TEACHER SUPPLEMENT

ANSWERS TO PREREQUISITE QUESTIONS:

a. Roll - to rotate on the longitudinal axis; to rock from side to side.

b. Glide - coast down hill on the air while propelled by the force of gravity.

c. Pitch - to rotate on the transverse or cross sectional axis; to tip up or down.

d. Yaw - to rotate around the vertical axis, to turn to the left or right.

ANSWERS TO EVALUATION QUESTIONS:

a. Yawing is counteracted by rudder.

b. Rolling is stabilized by constructing the plane's wings at an upward or dihedral angle.

c. Pitch is taken care of by the fixed horizontal stabilizers on the tail.

MODULE: Freeze or Antifreeze

CLUSTER: Transportation

OCCUPATION: service station attendant

PREREQUISITES AND PRETEST:

1. You are to be aware that hydrometer is a rod with gradiations on the side. It floats vertically in a liquid. The level at which it floats is numerically dependent on the density of the liquid. Because of this relationship, the hydrometer is a useful tool in the measurement of the density and solution concentration of such things as auto battery acid and radiator antifreeze. The lower the solution density, the lower it floats and the higher the solution density, the higher it floats. Automotive experts recommend the use of ethylene glycol as a permanent antifreeze in a car's heating and cooling system. A solution will prevent radiator freeze-up down to -67° F. They also suggest that at least a 33% solution be kept in the system during the warmer months. Percent for liquid concentrations is usually measured by volume rather than by weight.
2. Be able to work problems involcing proportin. Show your work and carry it out to the nearest .0. Use the general formula $\frac{a}{b} : \frac{c}{x}$ or $ax = bc$ and $x = \frac{bc}{a}$

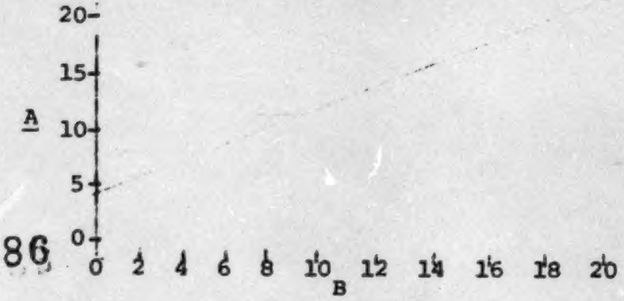
   a. 8 is to 50% as 6 is to_________%   c. 7 is to 36 as ______is to 65.

   b. 3 is to 66° as 5 is to_________$^{\circ}$
3. Be able to change fractions to percent. Show your work.

   a. 6/14 is___________% b. 12 is_______% of 25. c. 1 is_______% of 60.
4. Be able to graph two dependent variables and estimate to the nearest 1/2 unit, the value of one variable if the other variable is given.

   a. if the value of A is 15, the value of B is________.

   b. if the value of B is 4, the value of A is________.



OBJECTIVES:

1. You can construct a simple hydrometer from a pencil.
2. Given four solutions, 75% ethylene glycol, two unknowns, and pure water, you can take a hydrometer reading of each.
3. Given:
    a. the hydrometer readings of pure water, 75% antifreeze and 2 unknowns.
    b. the volume of an auto cooling system.
    c. the freezing point of the 75% antifreeze and of the pure water.

You can calculate:

a. the % of antifreeze in the two unknowns.
b. the freezing point of the unknowns.
c. the volume of antifreeze (in qts.) in each of the 4 solutions.

4. Given:
    a. the volume of antifreeze in an auto system.
    b. the total volume of the system.
    c. the freezing point of the solution.

By graphing the freezing point vs. % concenration, you can:

a. state how much antifreeze you place in a system of a total given volume for protection down to a given temperature.
b. state the freezing point for a known concentration of solution.

EQUIPMENT:
1 unsharpened eraser tipped pencil
4 large test tubes
1 ruler
60 mls. pure water
60 mls. 75% ethylene clycol
60 mls. each of 2 different solutions of 0-75% ethylene glycol
(% conc. known only to instructor)
graph paper

PROCEDURE:

1. Measure off 1/4 inch marks along the full length of the side of the pencil, Number the markings from 1 to 25 starting from the end opposite the eraser tip.
2. Float the pencil vertically, eraser tip down inthe test tubes of pure water, 75% antifreeze and each of the two unknowns. Take care that the hydrometer pencil does not stick to the side of the test tube. Record the hydrometer readings to the nearest 1/2 hydrometer unit.
3. Calculate each of the other bits of missing information to the nearest 1/2 unit. The concentrations of the **unknowns** will be between 0 and 75%. To make these calculations, use this formula for simple proportions:

    a. to find the % antifreeze in an unknown use -

$$\frac{\text{no. of hydrom. units (for 75\% solution) different from the hydrometer reading for water}}{\text{75\% antifreeze}} = \frac{\text{no. of hydrom. units (for unknown) different from hydrometer reading for water}}{\text{\% of (unknown)}}$$

    b. to find the number of degrees the freezing point is below 32° F use -

$$\frac{75\%}{99^{\circ}} : \frac{\text{Unknown \%}}{\text{Unknown degrees}}$$

You'll know the Unknown % so then you can solve for the Unknown degrees.

    c. to find the quarts of antifreeze /14 qt. system -

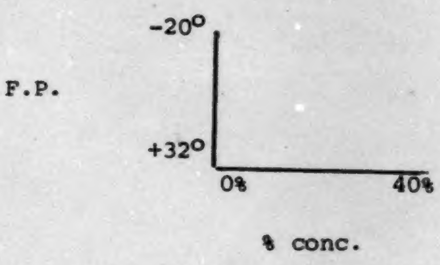
    % antifreeze espressed in hundreths x 14 quarts - qts. of antifreeze

DATA AND RESULTS

Solution	Pure Water	Unknown A	Unknown B	75% Antifreeze
Hydrometer reading				
No. of hydrometer units different from the hydr. read. for pure water	0			
% antifreeze	0			75
No. of degrees the freez. pt. is below 32° F.	0			99
Freezing point °F	32			67
Quarts of antifreeze per 14 qt. system	0			10½

EVALUATION: (Show all your work for calculations and answers to the nearest 1/2 unit)

1. There are 6 quarts of antifreeze in a 16 quart cooling system and the solution has a freezing point of -18° F. Of course a pure water solution would have a freezing point of 32°F. Using the % conc. and freezing point for the antifreeze solution as a point on a graph, and the % conc. and freezing point for water as another point on a graph, plot a graph of % conc. against freezing point on a separate sheet of graph paper. (Sample below:)



2. a. Using your graph, what % concentration of antifreeze would be needed for protection down to 0° F?

   b. How many quarts of antifreeze would this be?

3. a. Again using your graph, what would the freezing point be for a 10% solution?

   b. How many quarts of antifreeze would be in solution?

EVALUATION: (Show all your work for calculations and answers to the nearest 1/2 unit)

1. There are 6 quarts of antifreeze in a 16 quart cooling system and the solution has a freezing point of - 18°F. Of course a pure water solution would have a freezing point of 32°F. Using the % conc. and freezing point for the antifreeze solution as a point on a graph, and the % conc. and freezing point for water as another point on a graph, plot a graph of % conc. against freezing point on a separate sheet of graph paper. (Sample below:)

-20°

F.P.

+32°

0% 40%

% Conc.

2. a. Using your graph, what % concentration of antifreeze would be needed for protection down to 0° F?

MODULE: Freeze or Antifreeze

TEACHER SUPPLEMENT

PRETEST QUESTIONS:

2. a. $\frac{8}{50\%} : \frac{6}{X\%}$, X = 37.5%.

   b. $\frac{3}{66^\circ} : \frac{5}{X^\circ}$, X = 110°.

   c. $\frac{7}{36} : \frac{X}{65}$, X = 12.6.

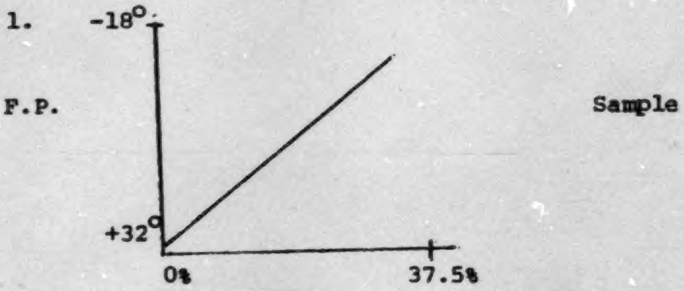
3. a. 42.9%, b. 48%, c. 1.7%

4. a. 13 (+ or -1)

   b. 7 1/2 (+ or -1)

EVALUATION:

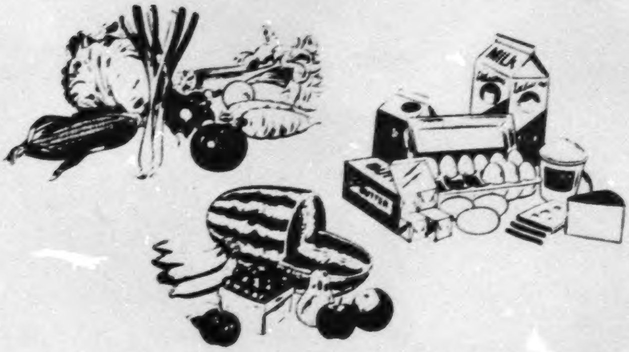
1.



2. a. 24% b. 3.8 qts.

3. a. 18.7° F. b. 1.6 qts.

MODULE: Moisture Content of Foods



CLUSTER: Consumer Foods & Homemaking

OCCUPATION: cook
food technologist

CLUSTER: Marketing & Distribution

OCCUPATION: butcher
marketing research

CLUSTER: Health

OCCUPATION: dietician
home economist

PREREQUISITES AND PRETEST:

1. The decimal equivalent of 3/4 is .75 .
   Change 3/8 to its decimal equivalent. 3/8 = __________.
2. Find a ratio. What is the ratio of boys in the class to total students in the class. (12 boys out of 26 total students)__________________________.
3. Define percent____.
   Find the percent of boys in the class in question #2.______________________.
4. Skill in measuring mass using a balance.

OBJECTIVES:

1. Given the mass of a sample of material and the amount of water in the sample, you can determine the percent of water in the sample.
2. Given a sample of food, you can design a testing procedure to determine the percent of water in the sample.
3. Given the cost per pound of a food sample and the percent of moisture in the sample, you can calculate the cost of water in the food sample.
4. Given a list of foods and their percent moisture content, you can arrange them in order of decreasing amount of moisture.

EQUIPMENT AND MATERIALS:

- heavy aluminum foil
- drying device, oven, burner, incubator
- balance and weights (0.1g)
- various food samples

PROCEDURE:

1. Obtain 2 tablespoons each of the following food samples:
   a. bread
   b. meat
   c. vegetable
   d. fruit

   These may be obtained from home, the school kitchen or your own lunch. Try to obtain the cost per pound for each food sample.
2. Make up 4 dishes by taking a 4 inch square piece of heavy aluminum foil, folding up the corners, and shaping into a bowl-like container. Weigh them to the nearest 0.1g (or 0.01g if a balance with that accuracy is available) and record in Table A.
3. Cut up food samples into tiny bits about the size of a kernel of corn. Place in the aluminum containers; weigh dishes and food samples, and record. Subtract the mass of the dish from the mass of the dish and food.
4. Place in a heating device to dry at 90° C or 175° F for 1 hour. Any oven will work well. If an oven is not available, heat to a constant weight over a Bunsen burner. Care should be taken not to heat too strongly and decompose for food samples. Samples may be left in the oven overnight.
5. Allow to cool and reweigh the aluminum containers and their contents. To find the mass of food after heating, subtract the mass of the dish from the food and dish after heating.
6. Find the mass of water by subtracting the mass of food after heating from the mass of food before heating and record.

DATA AND RESULTS:

TABLE A

Step	a.________	b.________	c.________	d.________
#1 Mass of Dish & Food				
#2 Mass of Dish				
#3 Mass of Food				
#4 Mass Before Heating				
#5 Mass After Heating				
#6 Mass of Water				

EVALUATION:

1. Calculate the percent of moisture in each food sample and fill in Table B.

2. a. record the price per pound of each of the foods you dehydrated.

   b. calculate the cost of water in one pound each sample by the following method. Multiply the price 1 pound of food times the % of water expressed in one hundreths (two decimal places).

3. a. which food contained the most moisture?____________________

   b. which food contained the least moisture?____________________

   c. if there are approximately 450 gm. in one pound, what is the price per gram of beef at $1.10 per pound? (Divide price per pound by 450 grams per pound to obtain price per gram)____________________

   d. what implications does water content of food have in the shipping and storing of food? ____________________

   e. arrange the food samples in order of decreasing amount of moisture.

4. If a sample of strawberries costs 40 cents per pound and they are 80% water, what is the cost of water in the sample?

TABLE B

Food	Mass of Water X100 Mass of Food Before Heating	Percent Water	Price /lb of Food	Cost of Water in one pound of food
a)				
b)				
c)				
d)				

MODULE: Moisture Content of Foods

TEACHER SUPPLEMENT

ANSWERS TO PRETEST QUESTIONS:

1. .375 or .38

2. Radio of $\frac{\text{boys}}{\text{total students}} = \frac{\text{12 boys}}{\text{26 students}}$ or simply 12 to 26 or 6 to 13

3. $\frac{\text{12 boys}}{\text{26 students}} = \frac{12}{26} = \frac{6}{13} = .461$ 461 x 100 - 46.1 or 46%

ANSWERS TO EVALUATION QUESTIONS:

3. a. vegetables and fruits tend to have a high moisture content especially cabbage, lettuce, celery.

   b. breads tend to have a low moisture content.

   c. if beef is $1.10/pound then

   $\frac{\$1.10/\text{pound}}{450\ \text{g/pound}} = \frac{\$1.10}{450\ \text{g}} =$ .25 cents or $.0025 per gram

   d. the cost of shipping is normally based on weight of materials. If water is removed then the cost will be less. Dehydrated products are often shipped to far away places and water added later. Campers often carry dehydrated foods to minimize the weight they must carry. Since storage costs are normally based on the volume of the material by removing the water, food may be stored less expensively if dehydrated. Dehydrated foods do not spoil as easily as foods with moisture in them. Freeze dried foods are readily available in the market.

   e. normally the moisture content of food will be:

vegetables	75 - 95%
fruit	75 - 90%
meat	20 - 70%
bread	20 - 50%

4. $ .32